

Non-medicinal Adjuvants

To

Glaucoma Treatment

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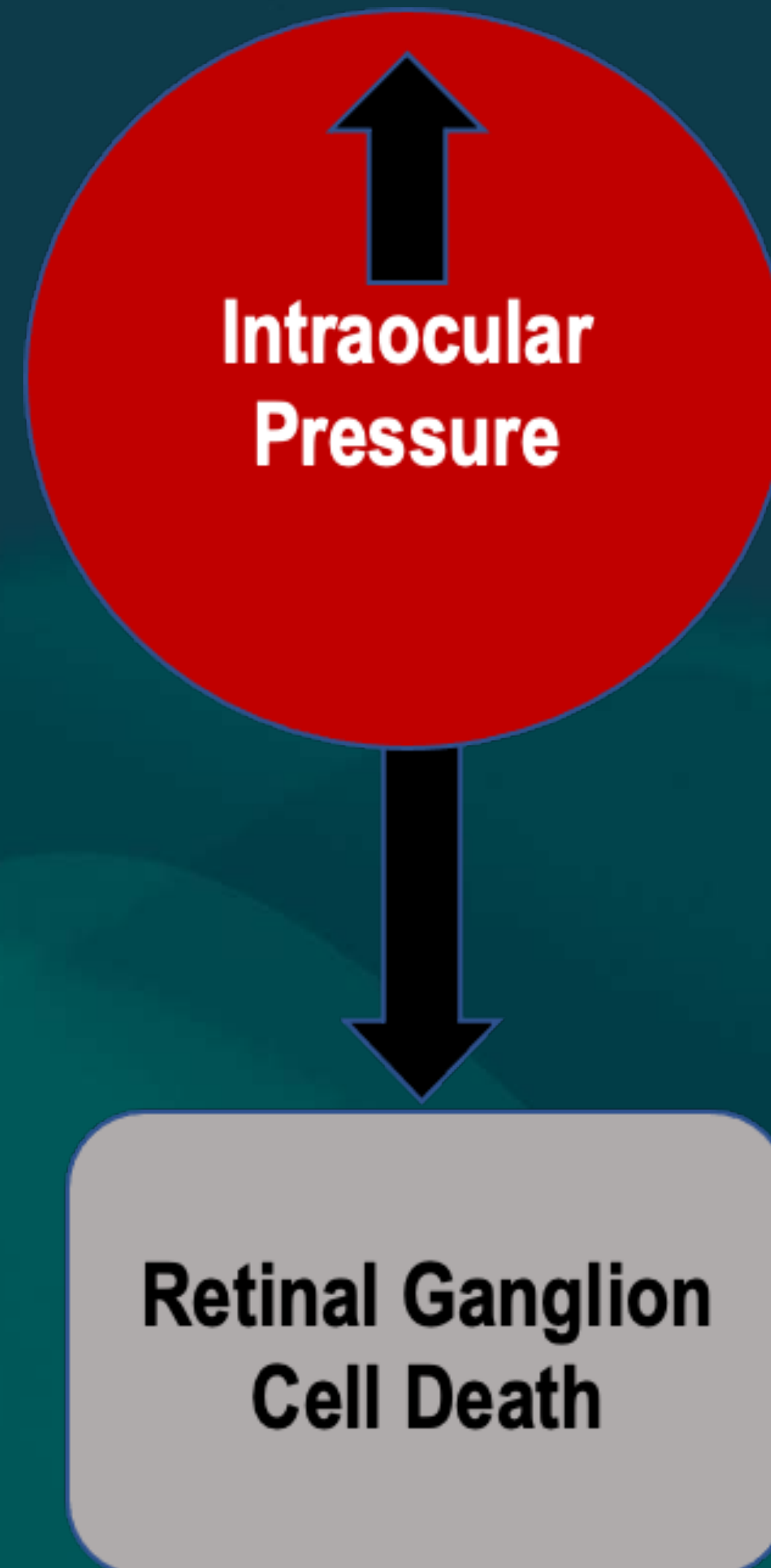
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To

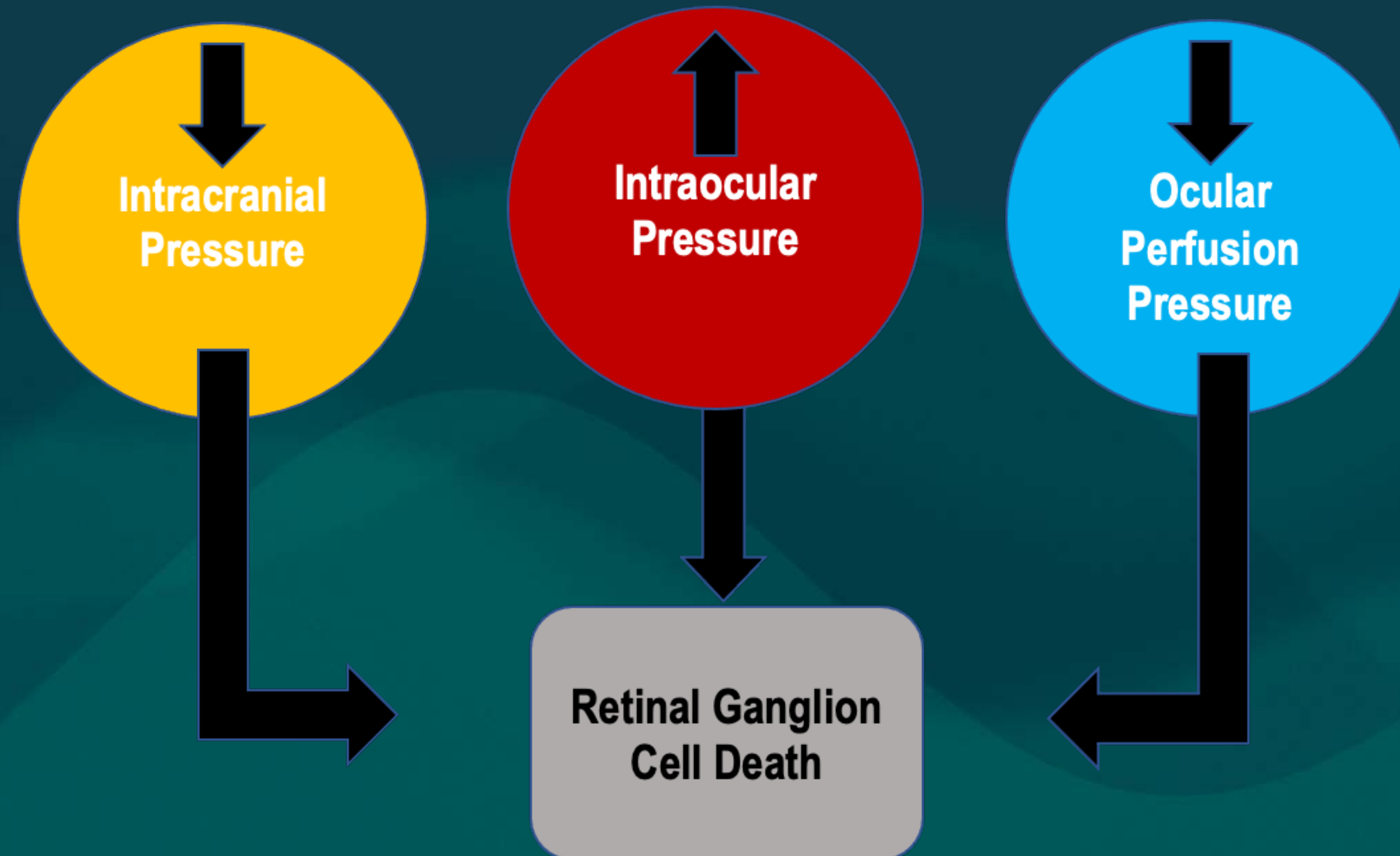
Glaucoma Treatment

Why Glaucoma Treatment Needs More Than
Pressure Control????

Why Glaucoma Treatment Needs More Than Pressure Control????



Why Glaucoma Treatment Needs More Than Pressure Control????



**Apoptosis
and
Autophagy**

Autoimmunity

**Neurotrophins
and
Excitotoxins**

**Oxidative
Stress**

**Intracranial
Pressure**

**Intraocular
Pressure**

**Ocular
Perfusion
Pressure**

**Retinal Ganglion
Cell Death**

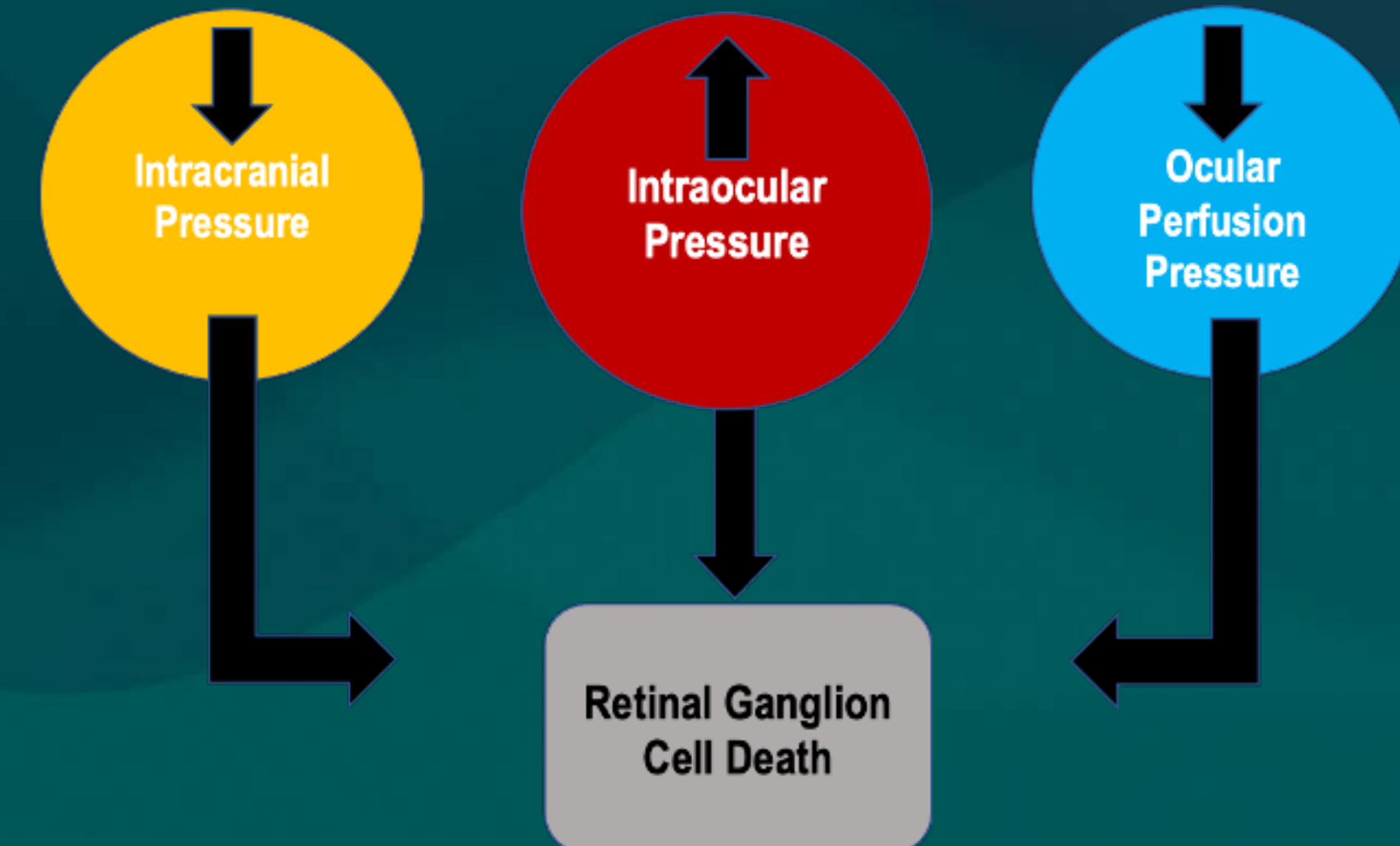
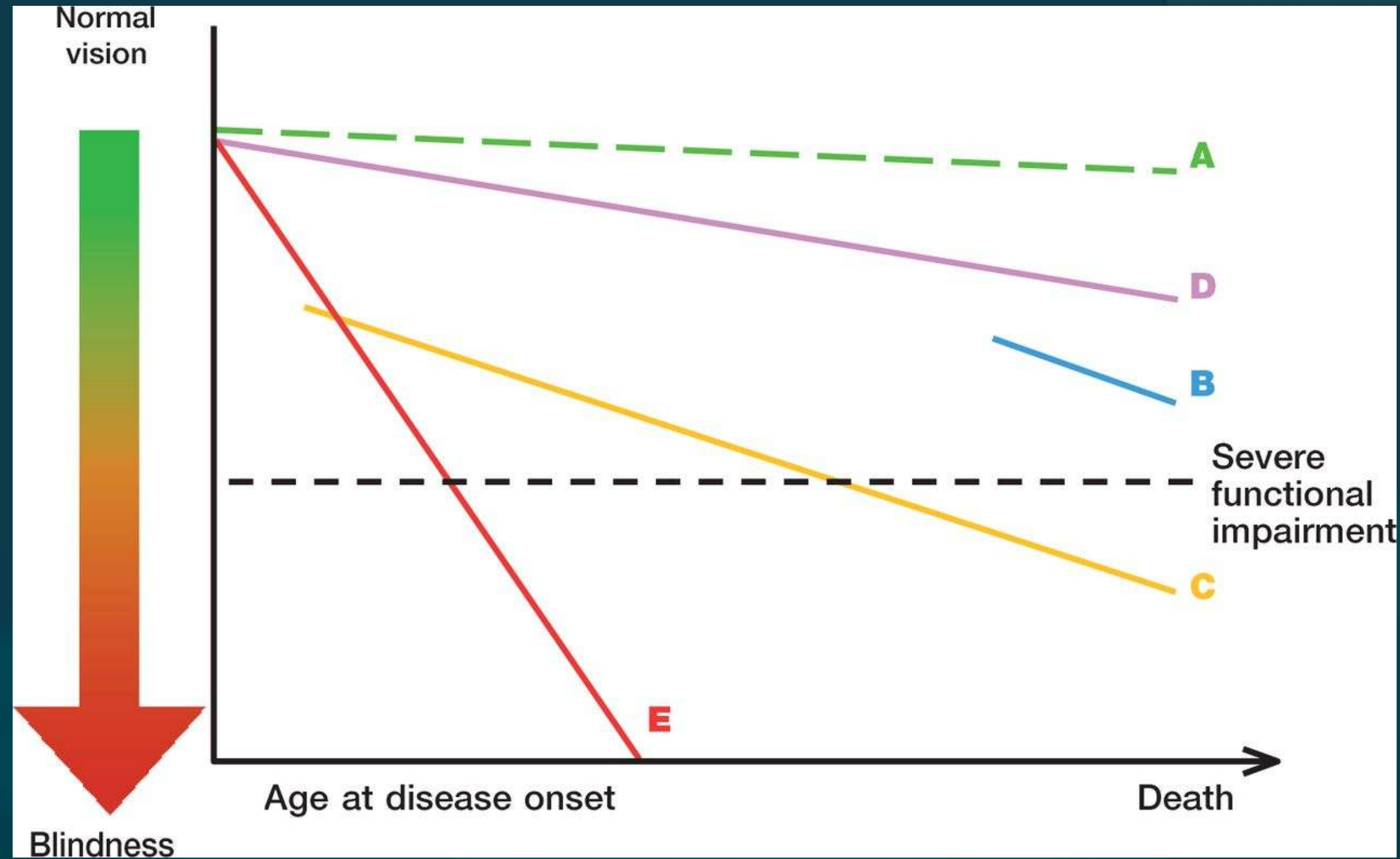
Apoptosis
and
Autophagy

Autoimmunity

Neurotrophins
and
Excitotoxins

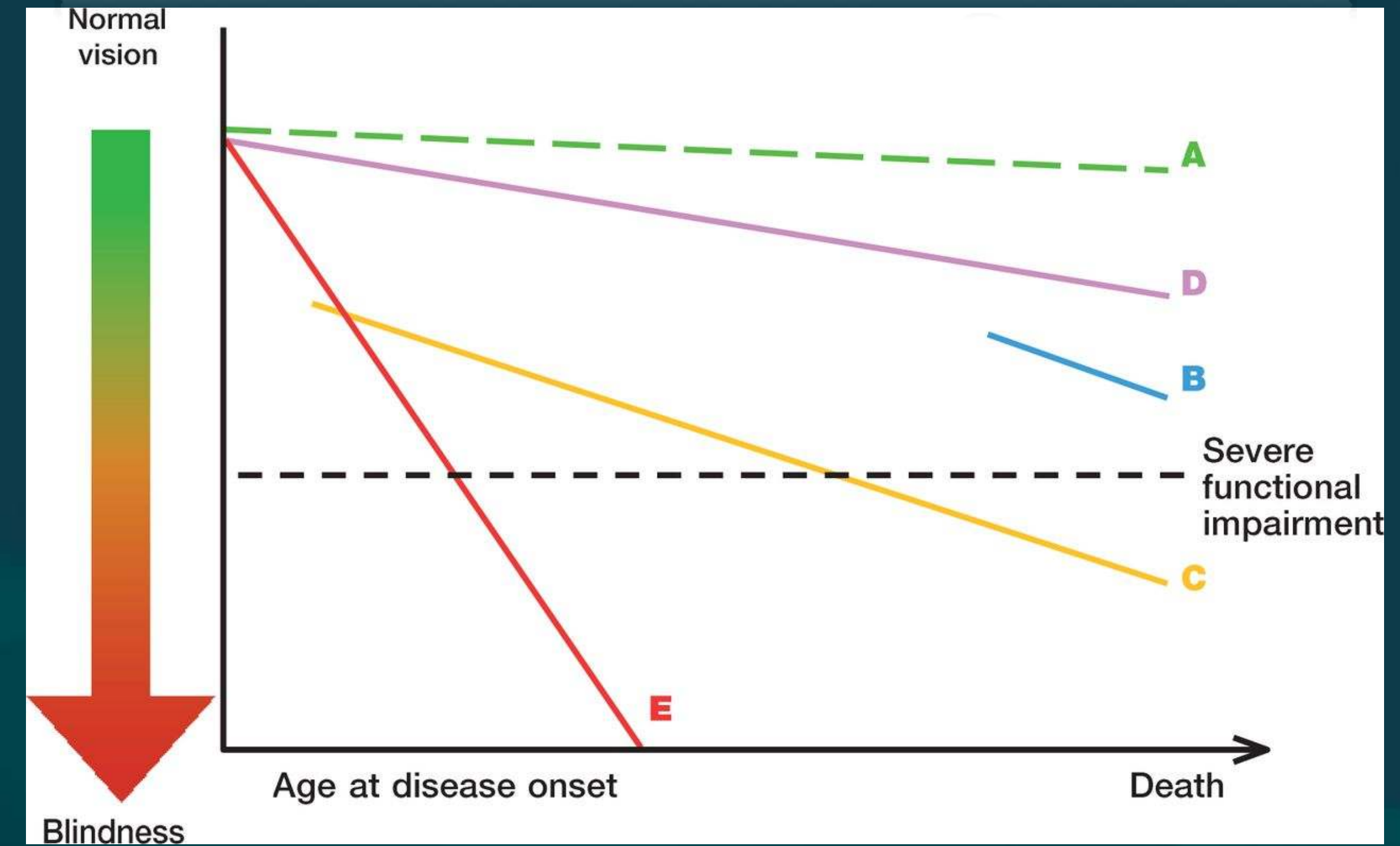
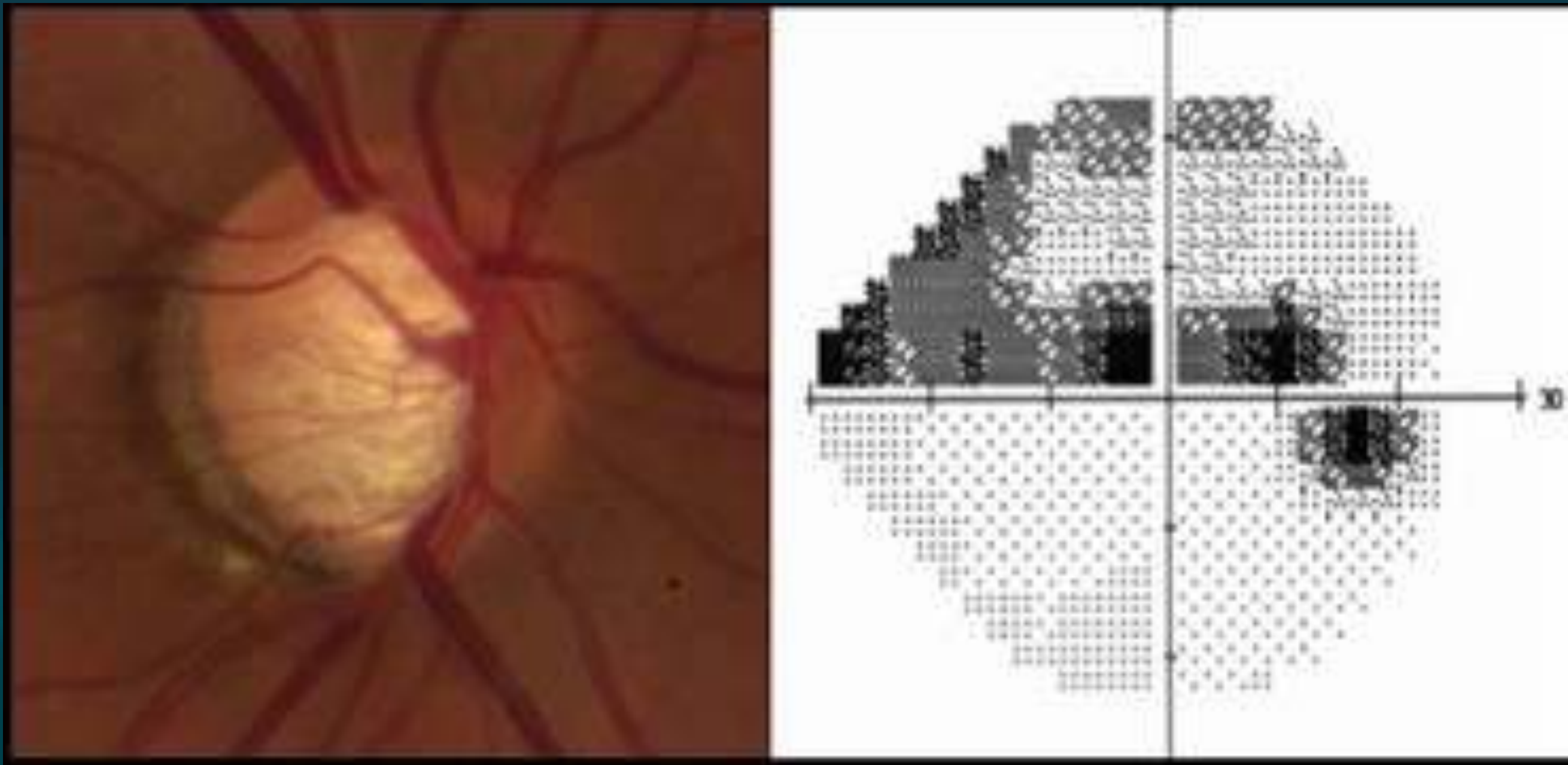
Oxidative
Stress

Different Rates of Progression?



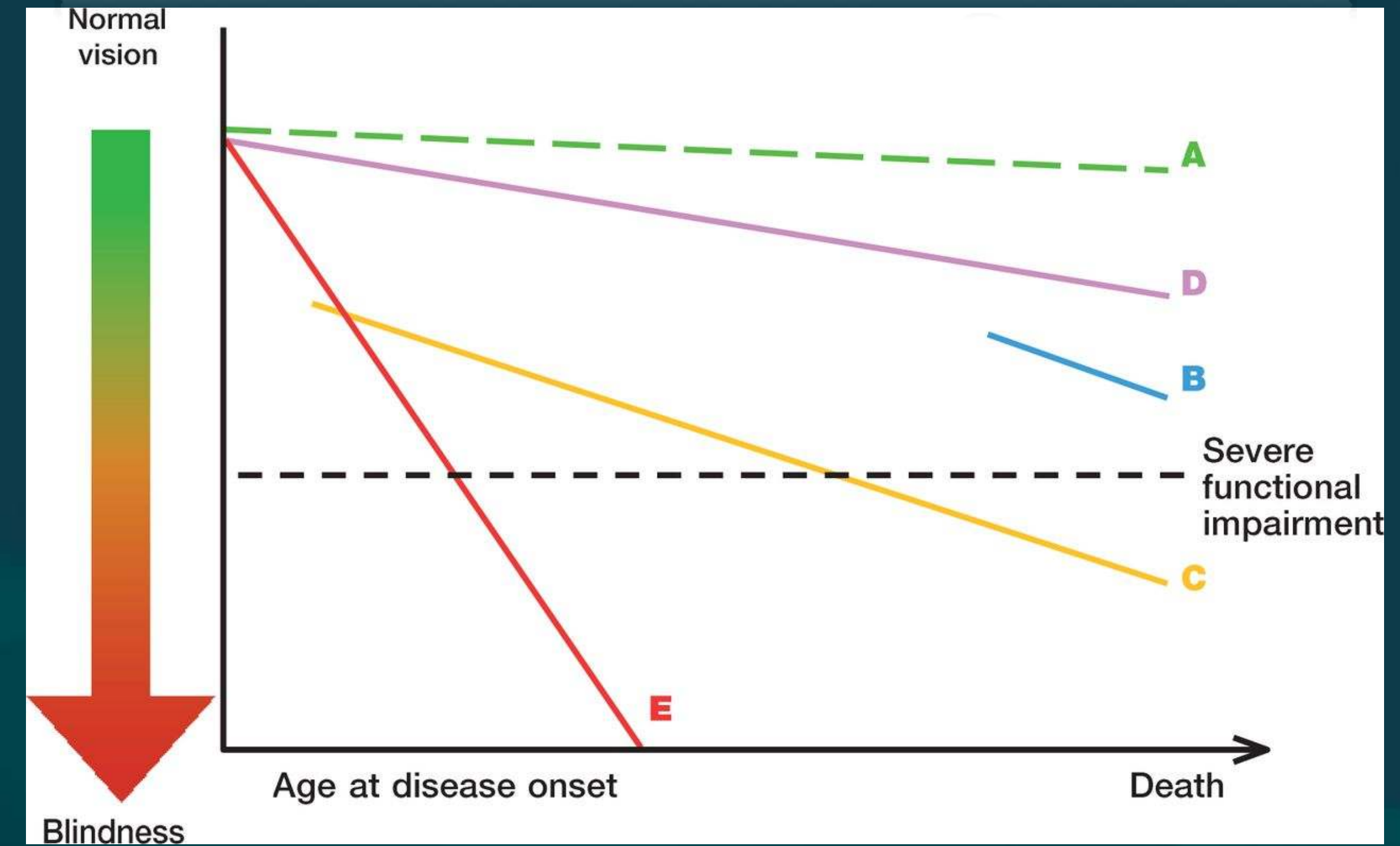
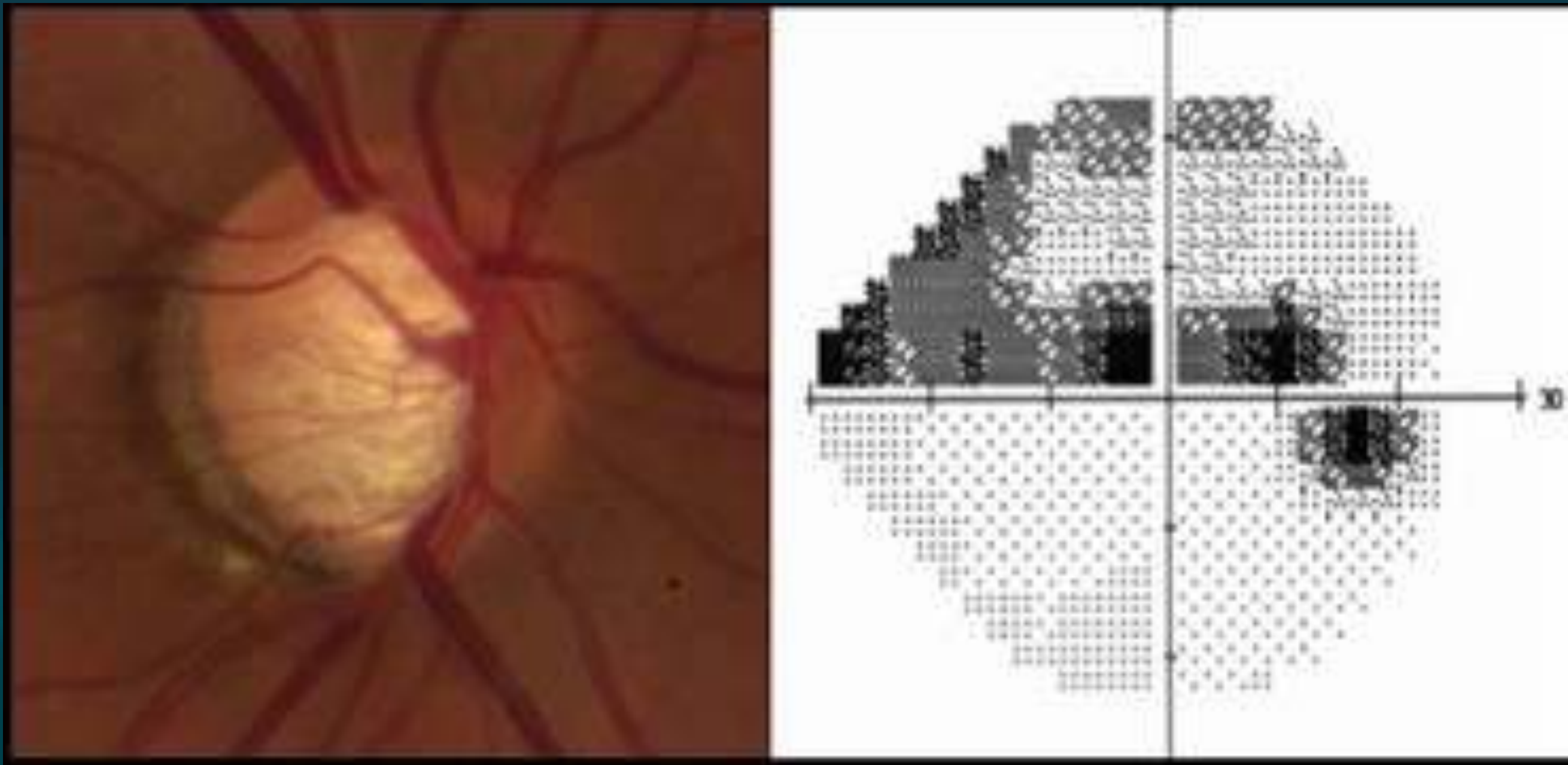
Different Rates of Progression?

Normal Tension Glaucoma?



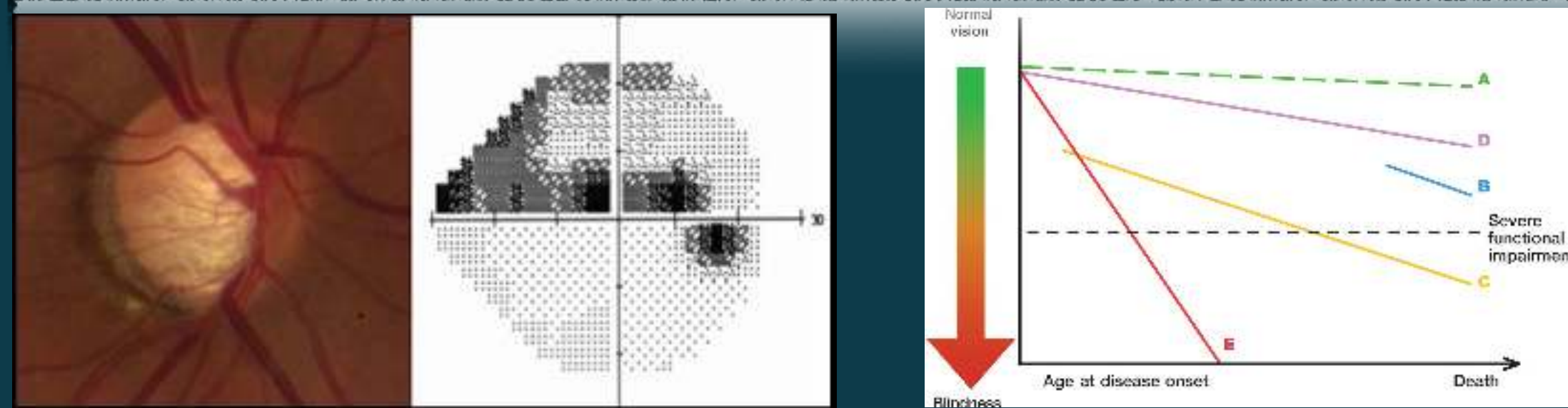
Different Rates of Progression?

Normal Tension Glaucoma?



Different Rates of Progression?

Normal Tension Glaucoma?



Non-IOP Related Factors Contributing to Glaucomatous Optic Nerve Damage

Low Ocular Blood Flow

Low Intracranial Pressure

Apoptosis and Autophagy

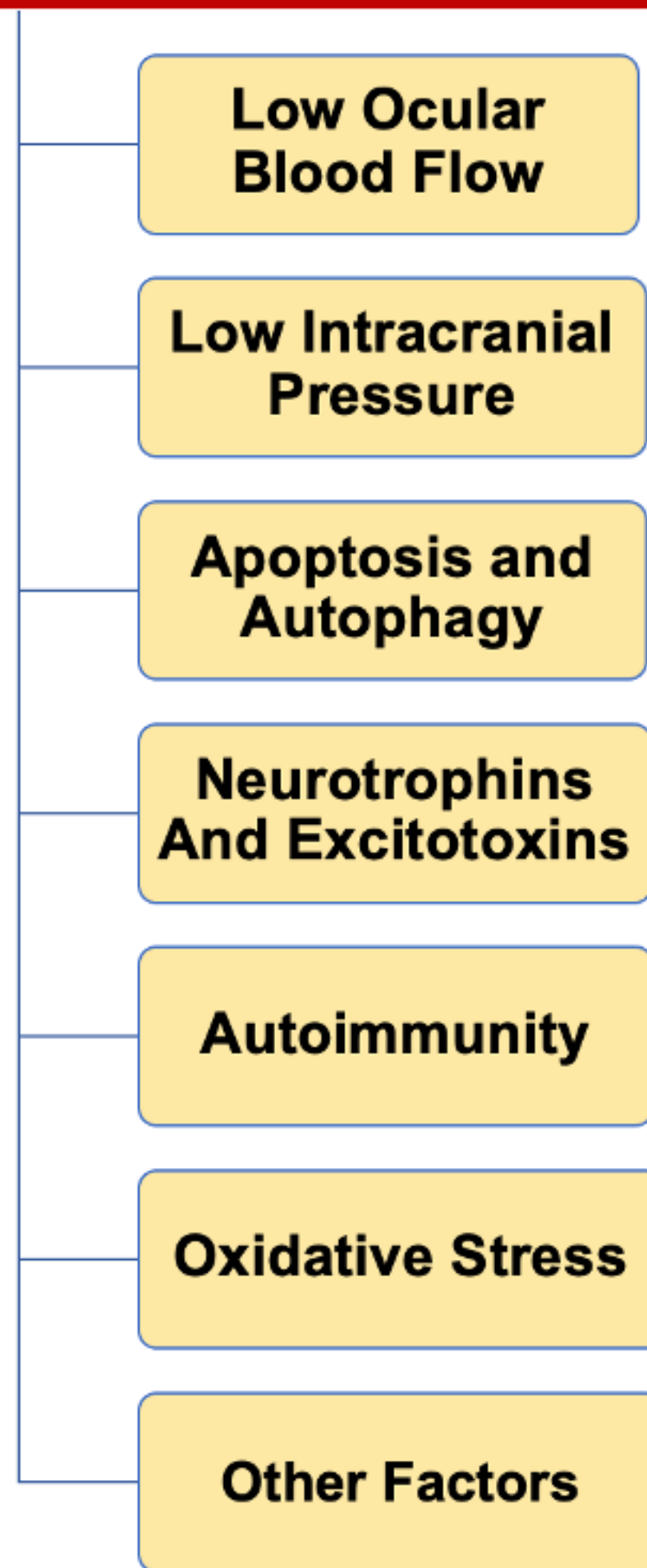
Neurotrophins And Excitotoxins

Autoimmunity

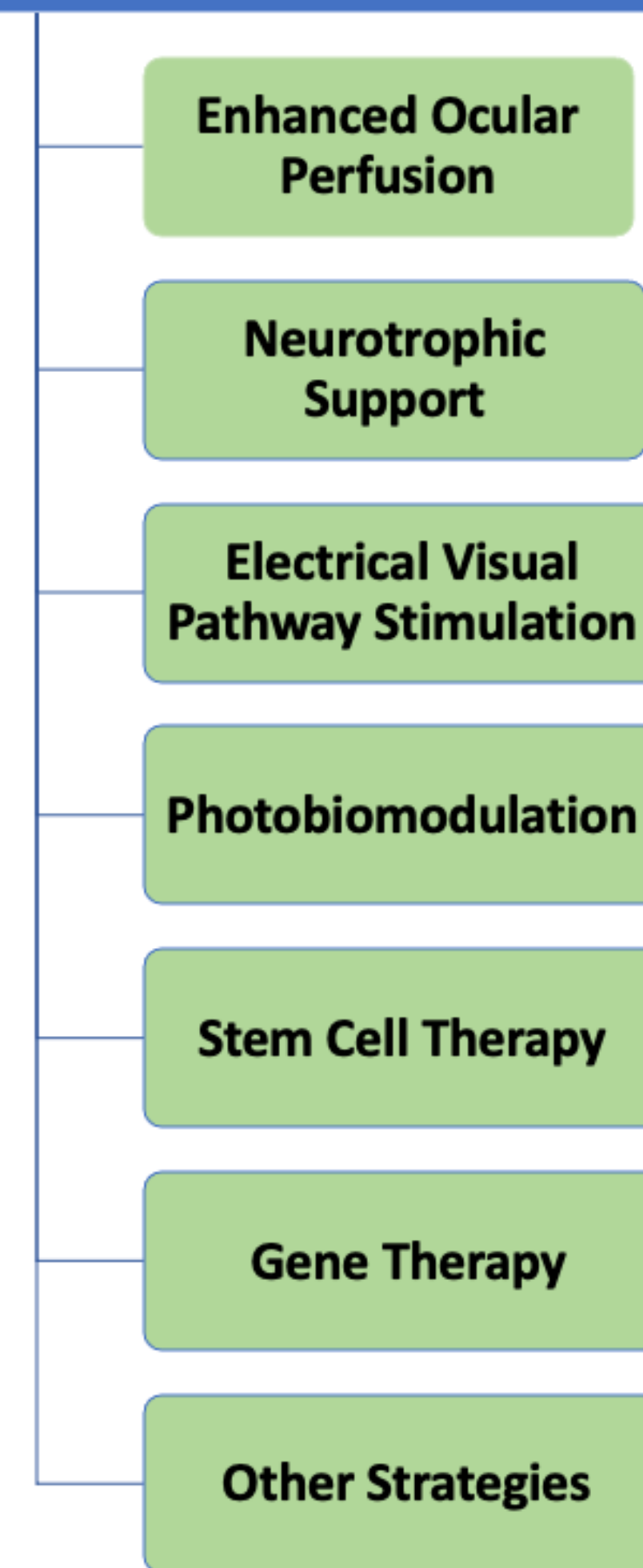
Oxidative Stress

Other Factors

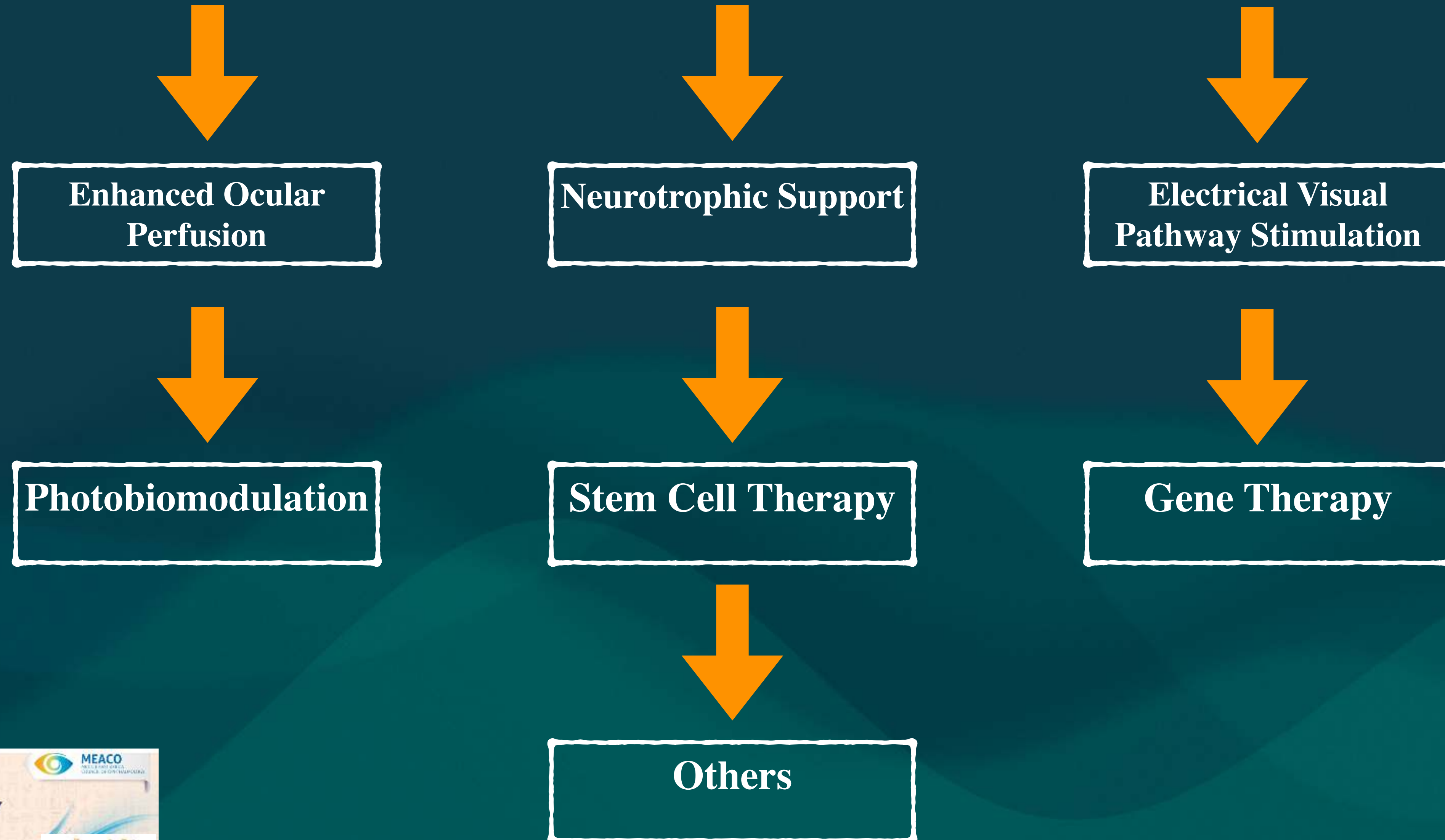
Non-IOP Related Factors Contributing to Glaucomatous Optic Nerve Damage



Glaucoma Treatment Strategies Other Than IOP Reduction



Treatment Options Other Than IOP Reduction



Treatment Options Other Than IOP Reduction



Enhanced Ocular
Perfusion

Enhanced Ocular Perfusion



IOP Reduction

Enhanced Ocular Perfusion

IOP Reduction



Surgically-induced



Medically-induced

Enhanced Ocular Perfusion



IOP Reduction



Vasodilators

Enhanced Ocular Perfusion

IOP Reduction

Vasodilators



Calcium Channel Blockers

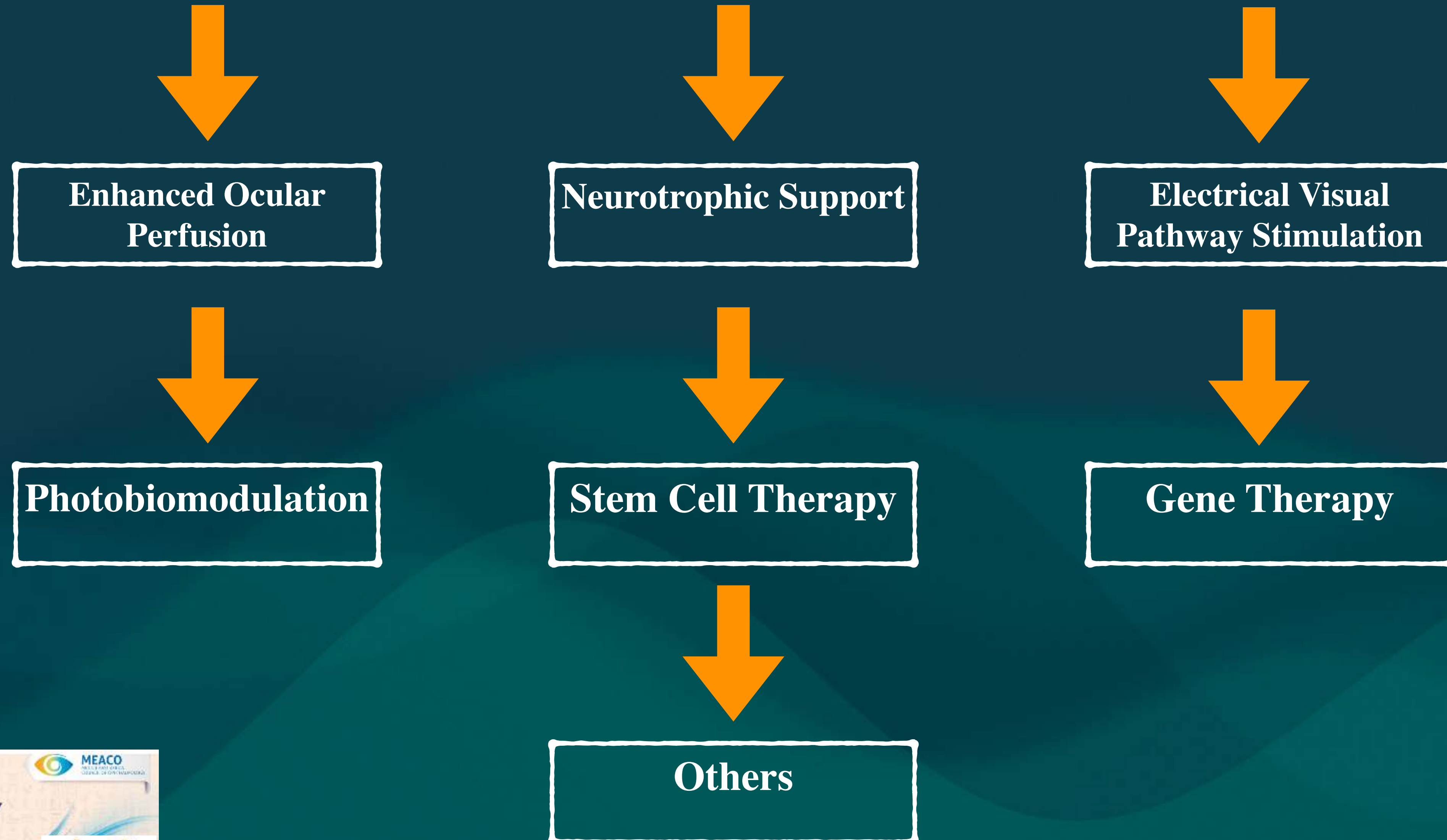
Enhanced Ocular Perfusion

Calcium Channel Blockers



- ▶ Decrease vascular resistance of the retinal and optic nerve head microcirculation.
- ▶ Neuroprotection.
- ▶ IOP Reduction.

Treatment Options Other Than IOP Reduction



Treatment Options Other Than IOP Reduction



Neurotrophic
Support

Neurotrophic Support



- ▶Support the growth, survival, and repair of neurons and promote axon regeneration.
- ▶Have been tried for other neurodegenerative disorders (Alzheimer disease, ALS, and Parkinson disease).

Neurotrophic Support



Nerve growth factor (NGF)

Brain-derived neurotrophic factor (BDNF)

Glial-derived neurotrophic factor (GDNF)

Ciliary neurotrophic factor (CNTF)

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Topical

Intravitreal

Retrobulbar

Neurotrophic Support

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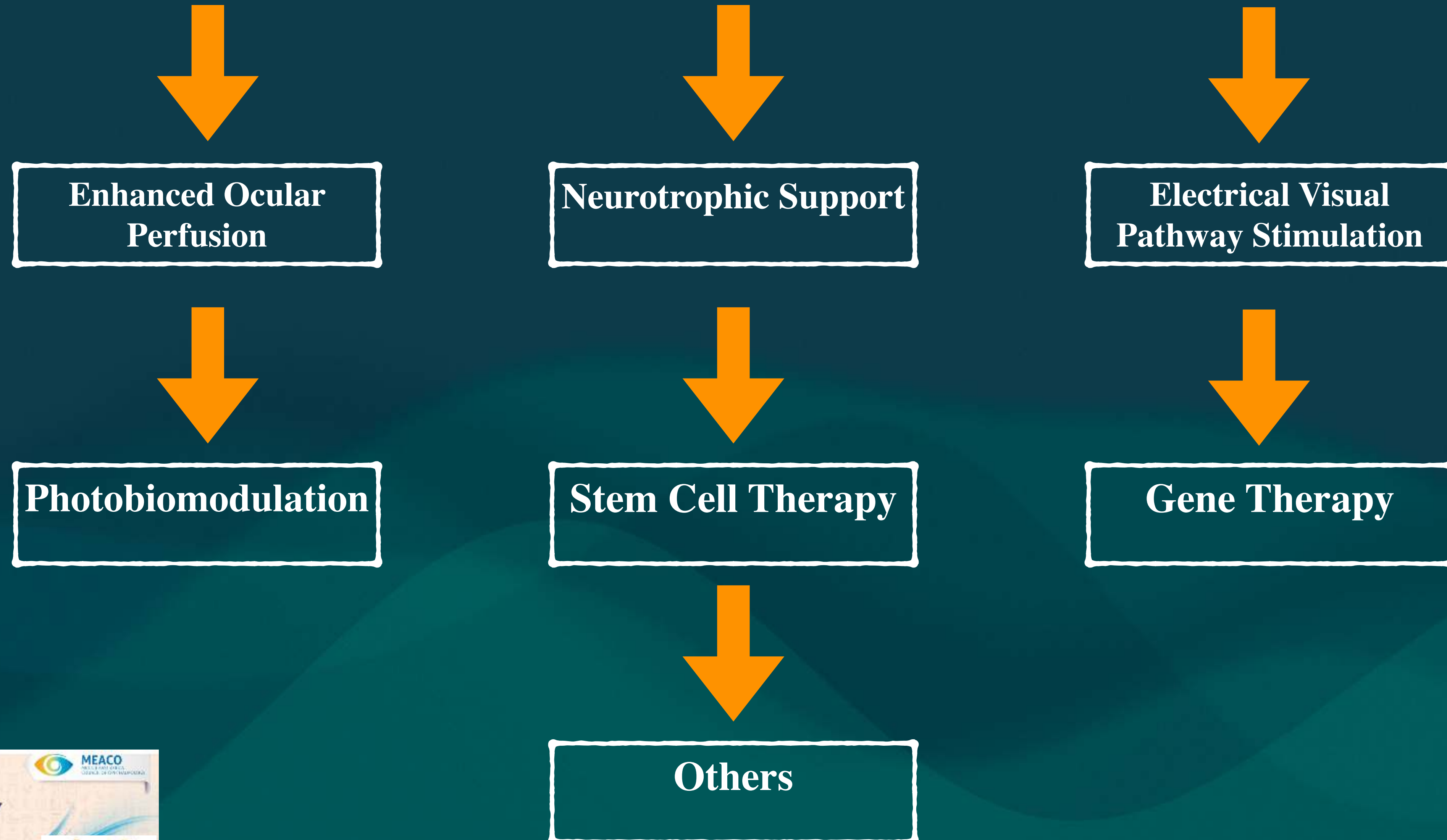
Topical

Intravitreal

Retrobulbar

►Preclinical studies have demonstrated that topical or intravitreal neurotrophic factors can prevent, slow, or reverse RGC death in animal models.

Treatment Options Other Than IOP Reduction



Treatment Options Other Than IOP Reduction



**Electrical Visual
Pathway Stimulation**

Electrical Visual Pathway Stimulation



- ▶ Dates back to 1873, when it was used to treat disorders including glaucoma, amblyopia and optic atrophy.
- ▶ Recent increased interest in the possibility of using electrical currents for neuroprotection and neurorestoration in optic nerve injury including glaucoma.

neuroprotection and neurorestoration in optic nerve injury including glaucoma.

Electrical Visual Pathway Stimulation



Transcorneal

Transpalpebral

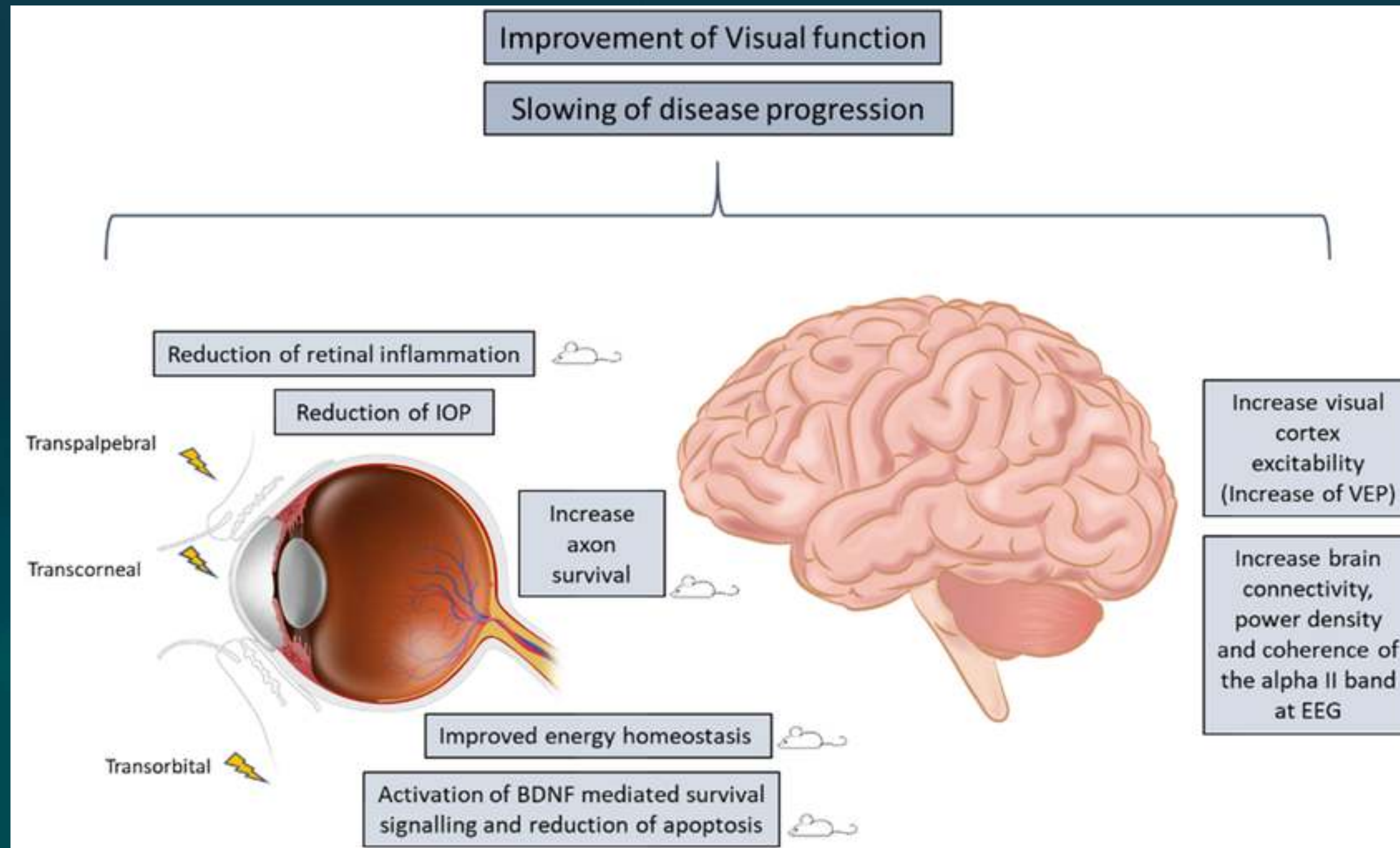
Transorbital

Transcranial

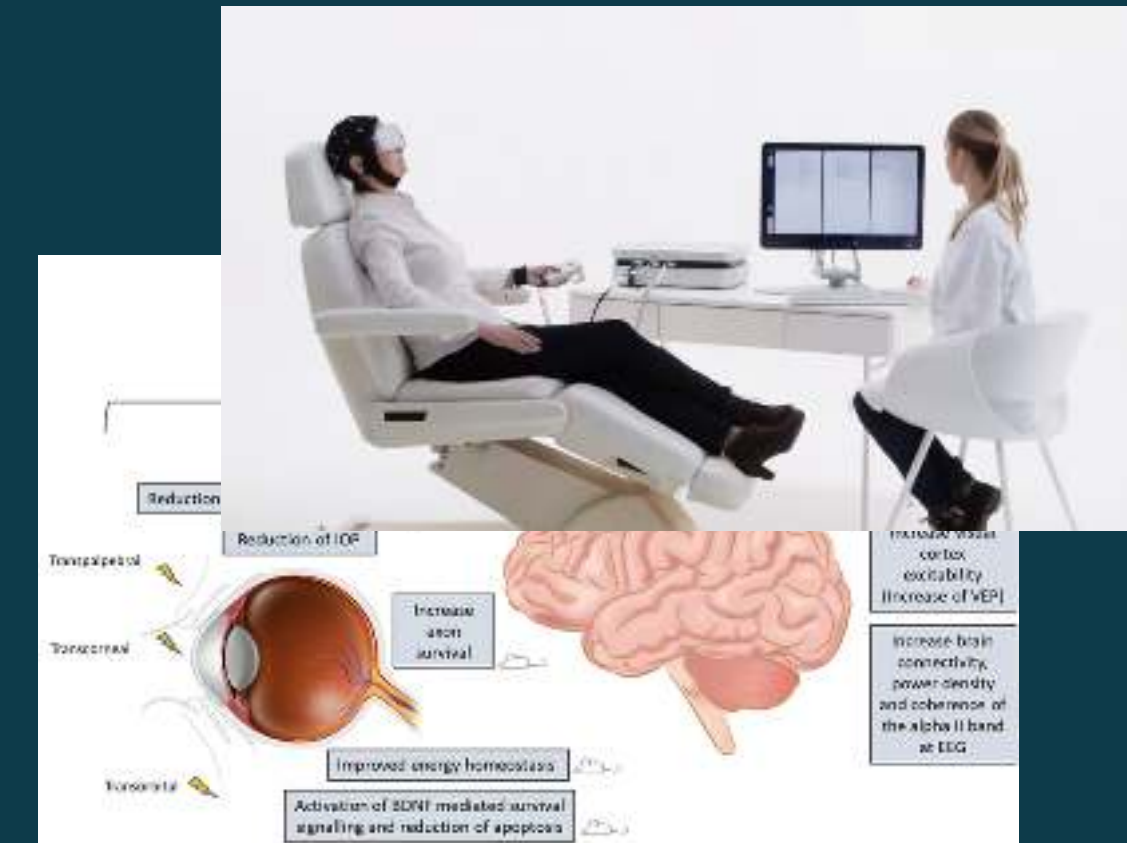
Electrical Visual Pathway Stimulation



Electrical Visual Pathway Stimulation



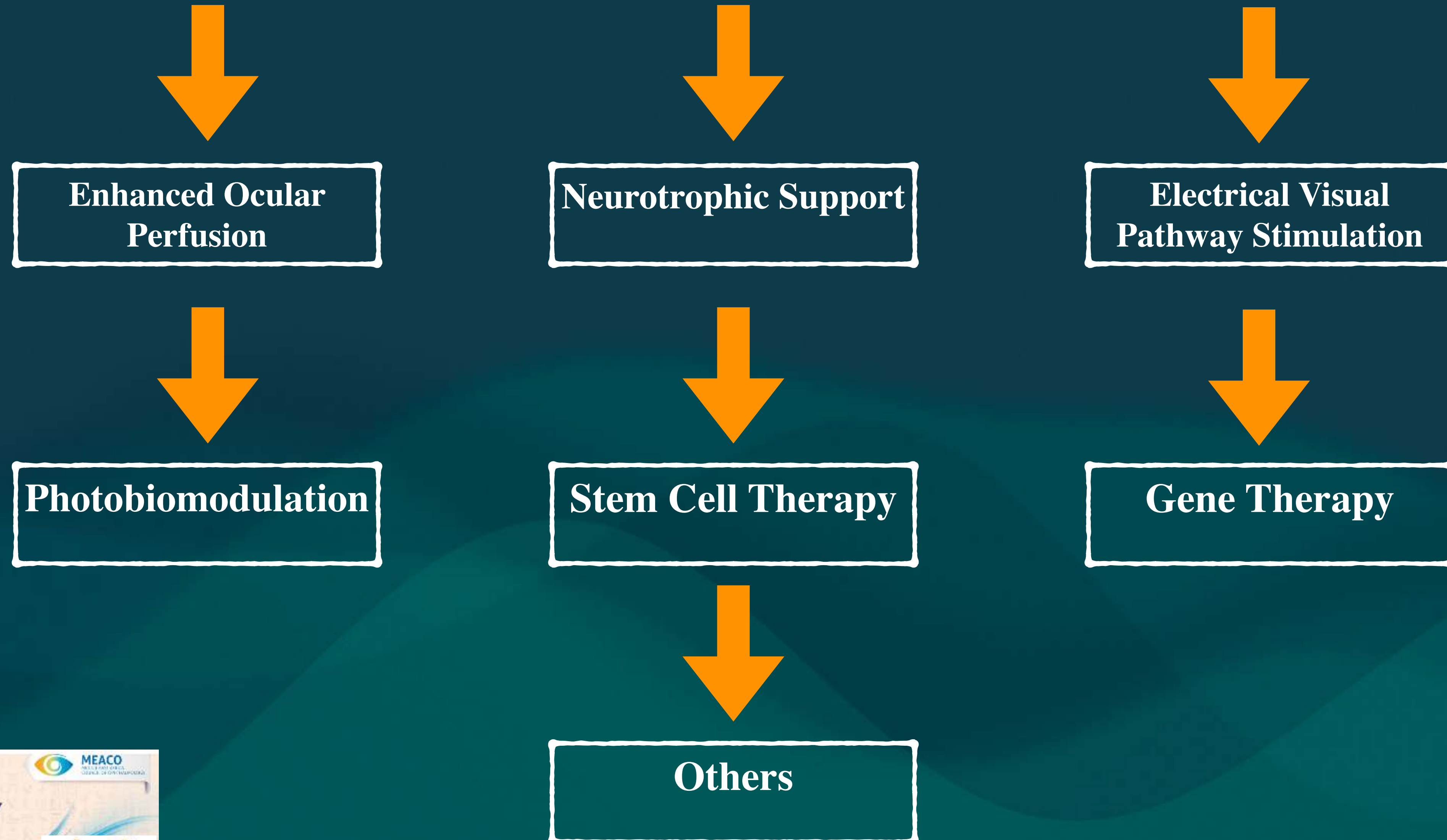
Electrical Visual Pathway Stimulation



► In a study of 78 medically treated and treatment naïve glaucomatous eyes, it showed a significant decrease in IOP measurements obtained 4 months after treatment with transpalpebral electrical stimulation..

“Electrical Visual Pathway Stimulation”

Treatment Options Other Than IOP Reduction



Treatment Options Other Than IOP Reduction



Photobiomodulation

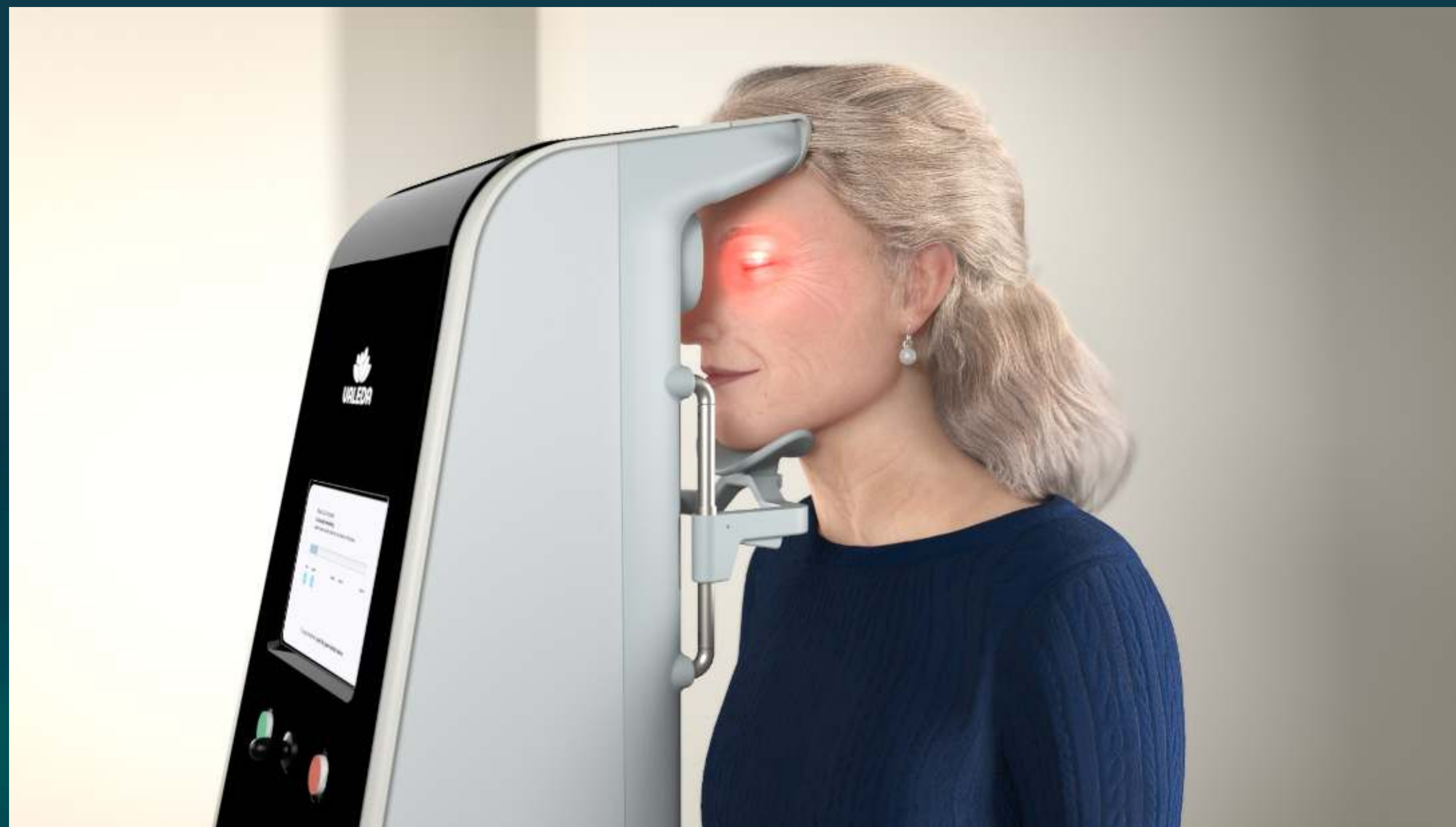
Photobiomodulation



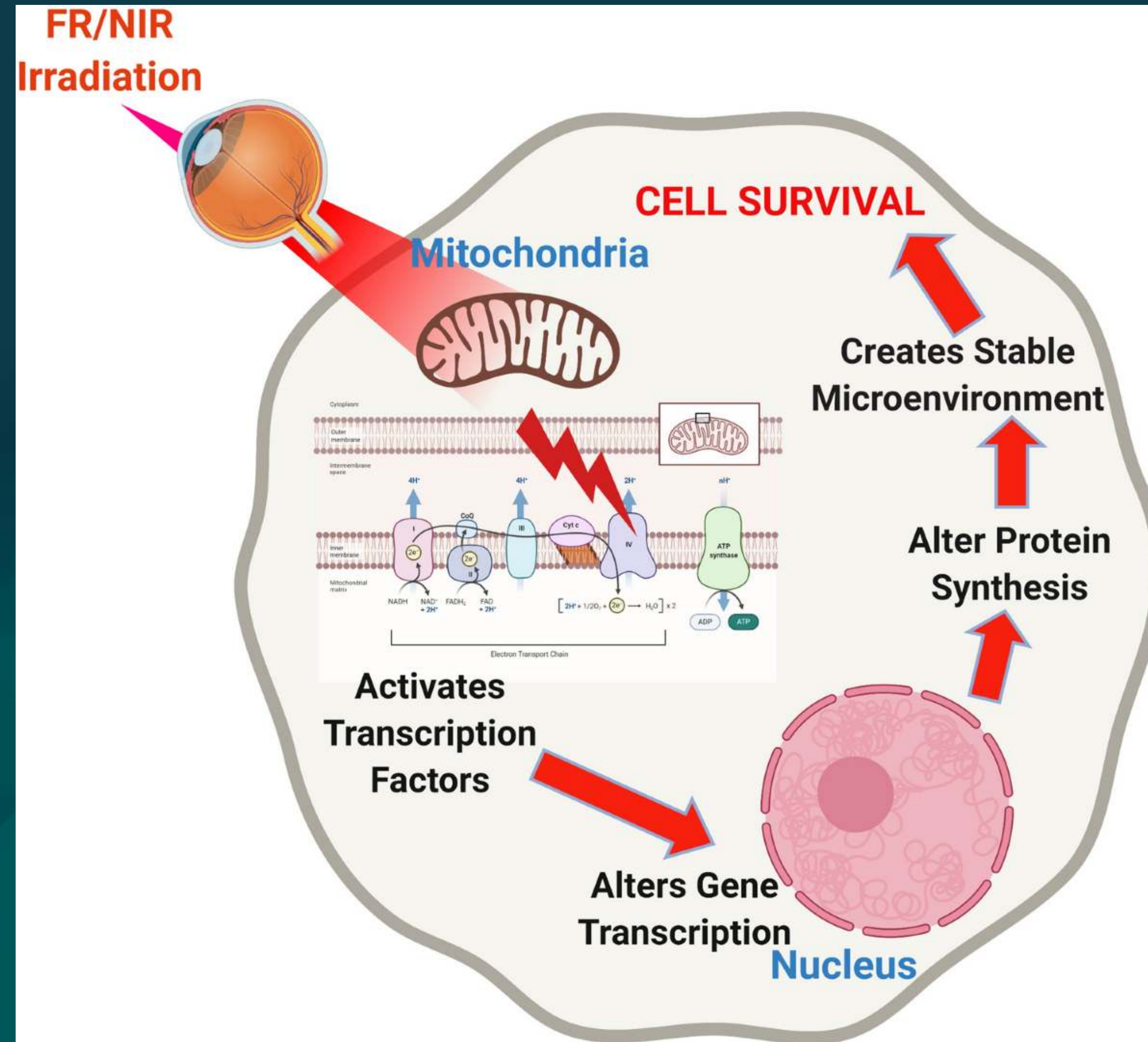
- ▶ Uses low power near-infrared light to stimulate, heal, and regenerate body tissues.
- ▶ Also, known as low level laser therapy.
- ▶ Has been found to be an effective treatment for various neurological conditions (stroke, traumatic brain injury, and neurodegenerative diseases).

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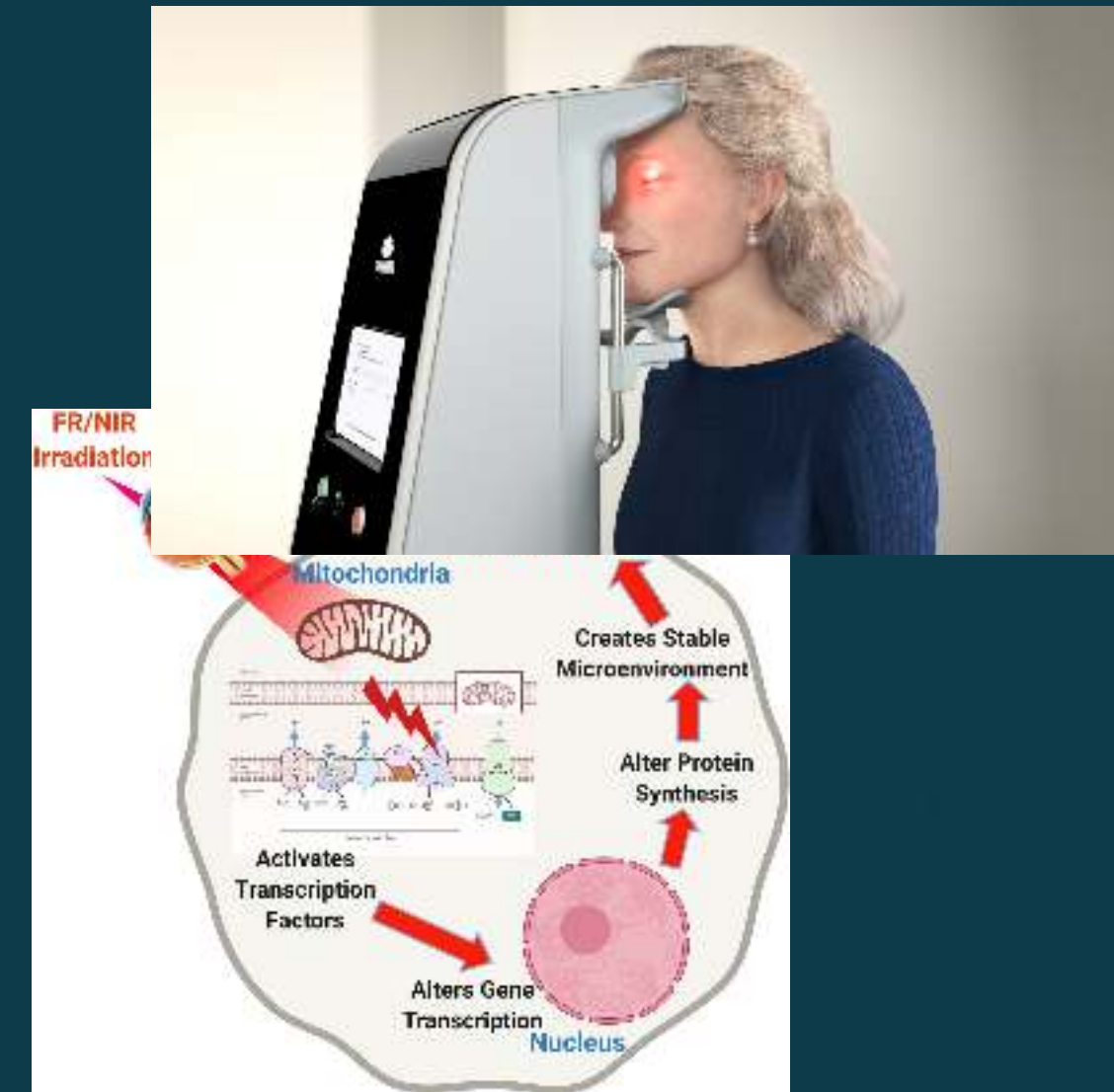
Photobiomodulation



Photobiomodulation

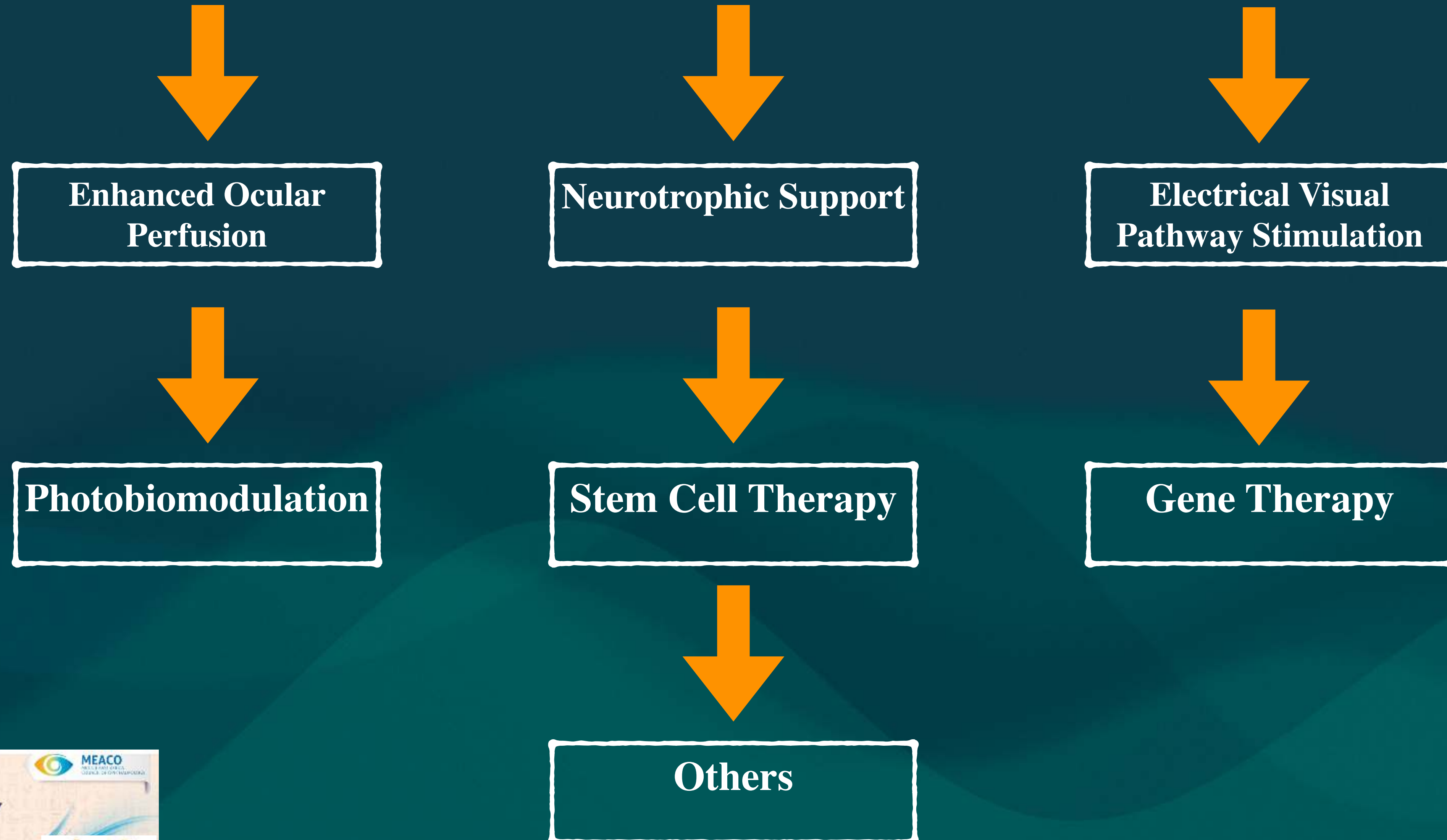


Photobiomodulation



►In its first major ophthalmic use to date, PBM has shown some promise of improving visual function in dryAMD.

Treatment Options Other Than IOP Reduction



Treatment Options Other Than IOP Reduction



Stem Cell Therapy

Stem Cell Therapy



►As of now, there are no approved therapies for treating glaucoma with stem cells, however, there are numerous clinical trials of investigational products that show promise in glaucoma and optic neuropathies.

promise in glaucoma and optic neuropathies.

Stem Cell Therapy



Embryonic

Mesenchymal

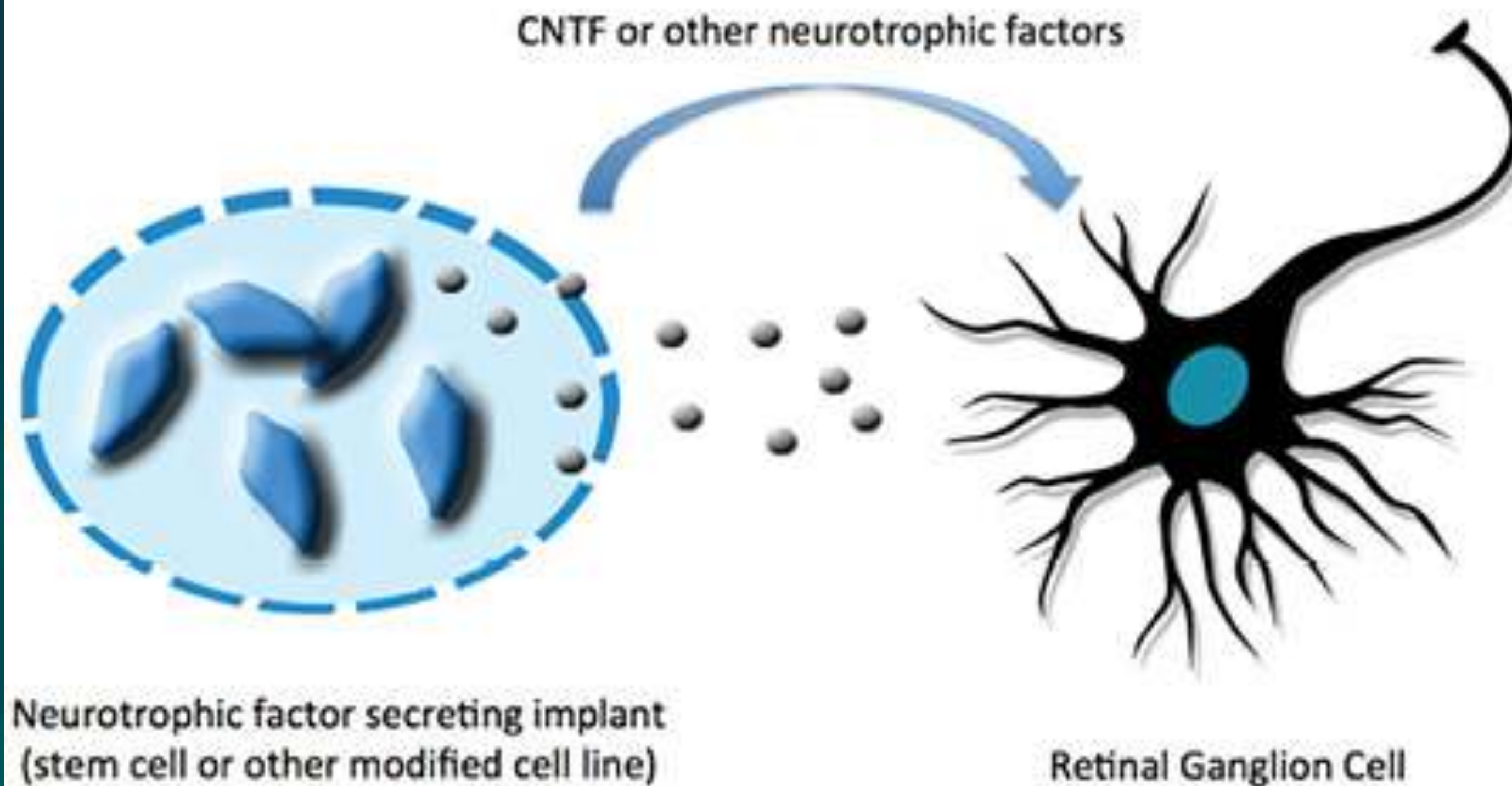
Neural Progenitor

Ocular Progenitor

Inducible Pluripotent Source

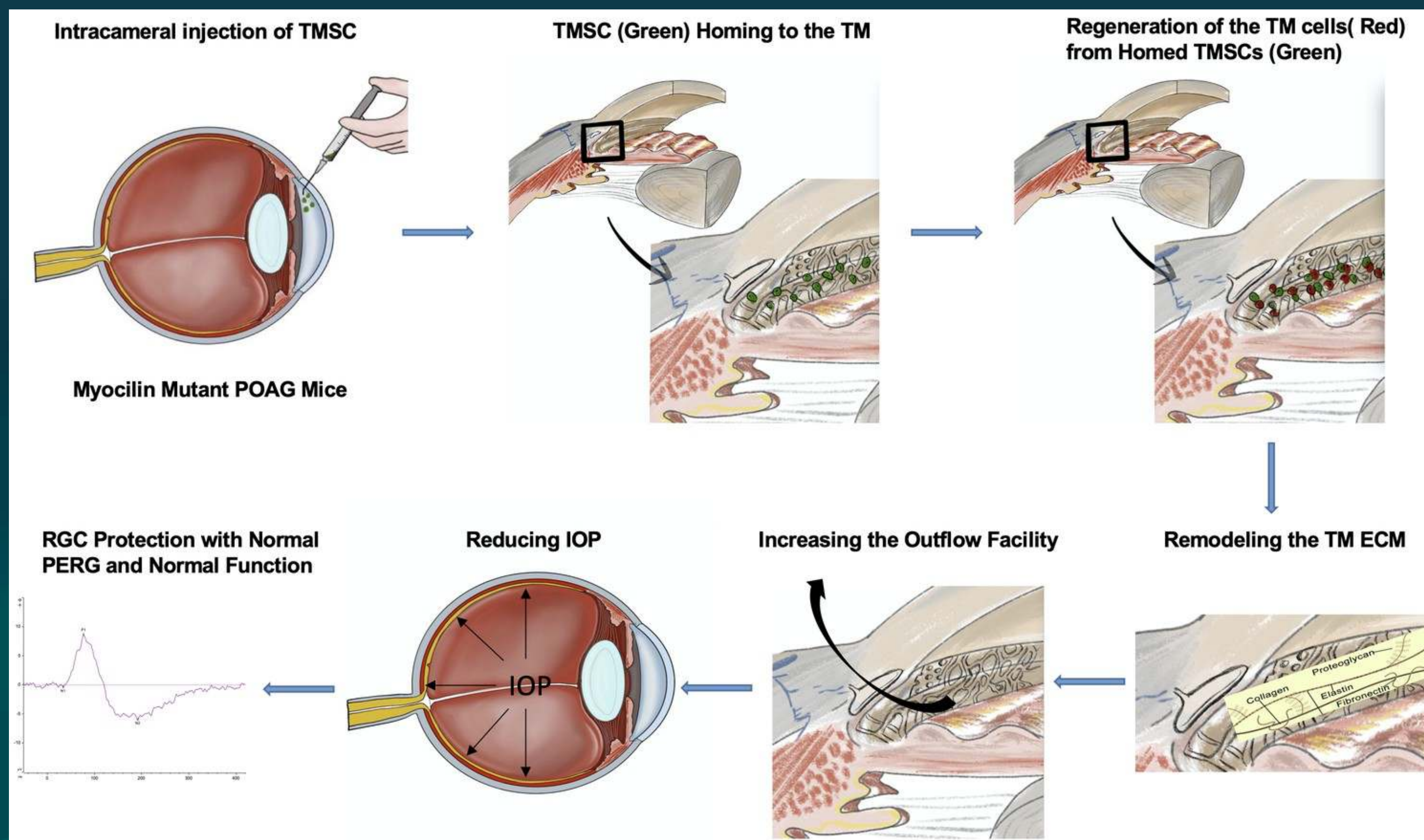
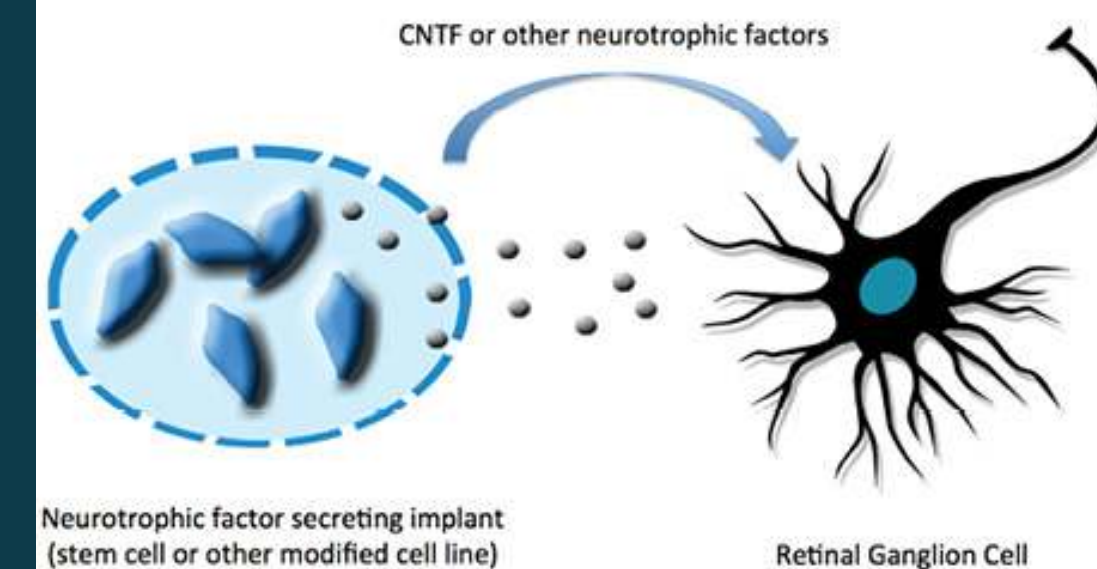
Stem Cell Therapy

Cell-based Neuroprotection/Neuroenhancement Therapy

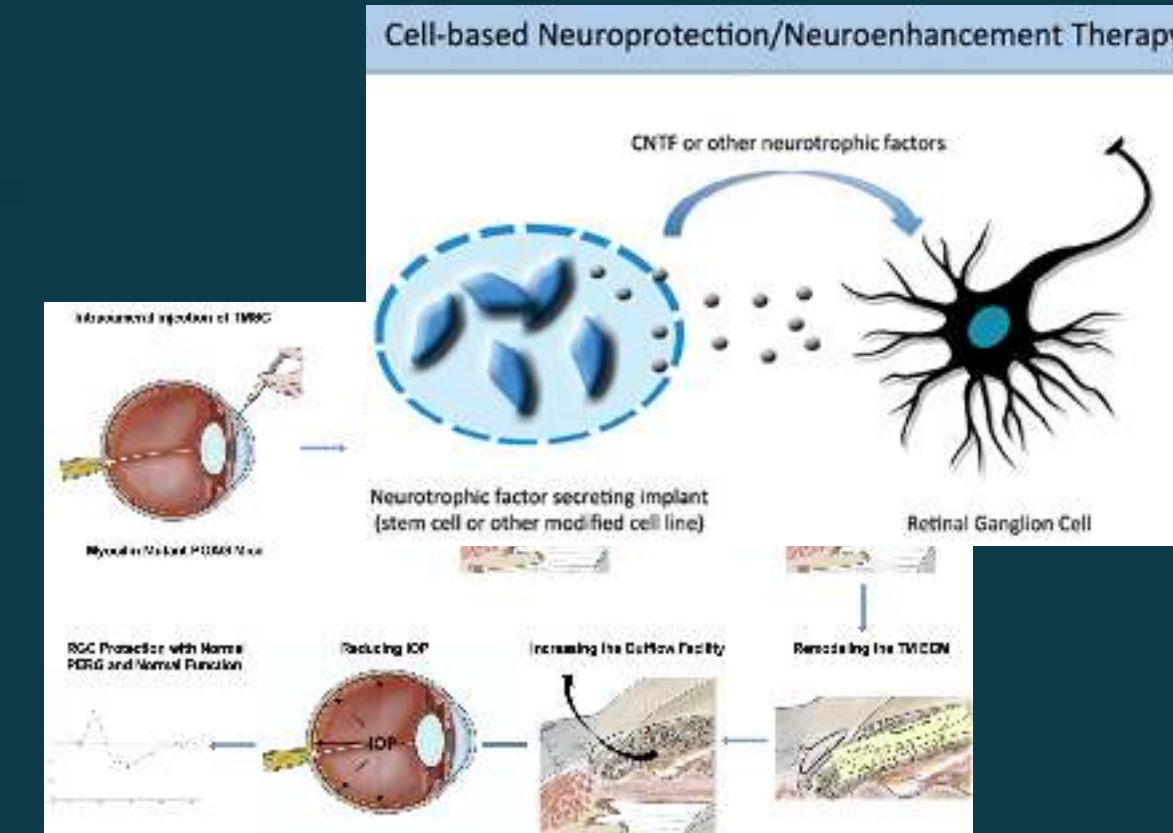


Stem Cell Therapy

Cell-based Neuroprotection/Neuroenhancement Therapy



Stem Cell Therapy



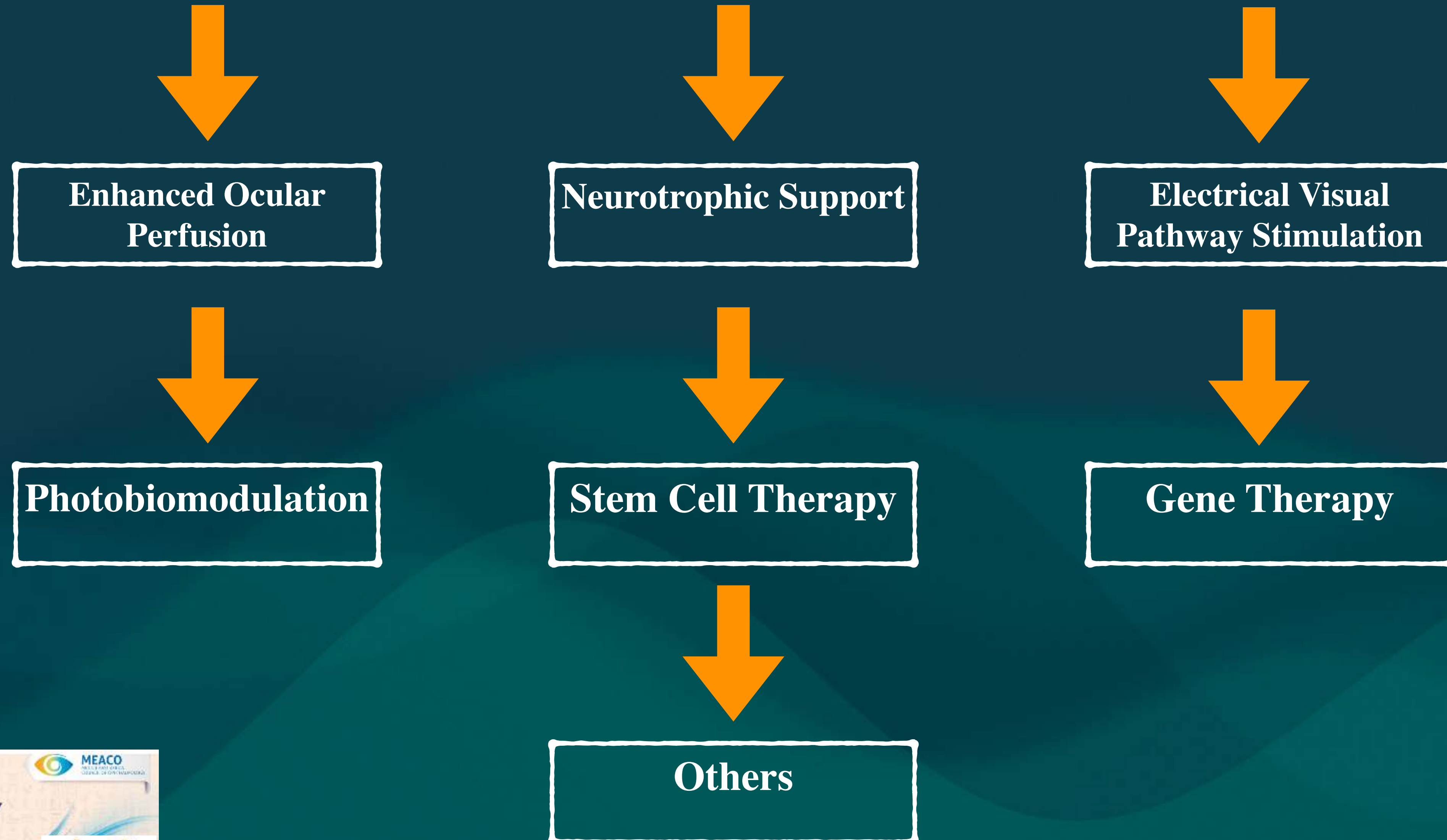
►Currently there are at least four registered clinical trials underway to investigate the use of stem cells in glaucoma.

- ◎The Intravitreal Mesenchymal Stem Cell Transplantation in Advanced Glaucoma study (NCT02330978),
- ◎The Stem Cell Ophthalmology Treatment Study (SCOTS) (NCT01920867 and NCT03011541).
- ◎The Effectiveness and Safety of Adipose-Derived Regenerative Cells for Treatment of Glaucomatous Neurodegeneration study (NCT02144103)

Neurodegeneration study (NCT02144103)

◎The Effectiveness and Safety of Adipose-Derived Regenerative Cells for Treatment of Glaucomatous

Treatment Options Other Than IOP Reduction



Treatment Options Other Than IOP Reduction



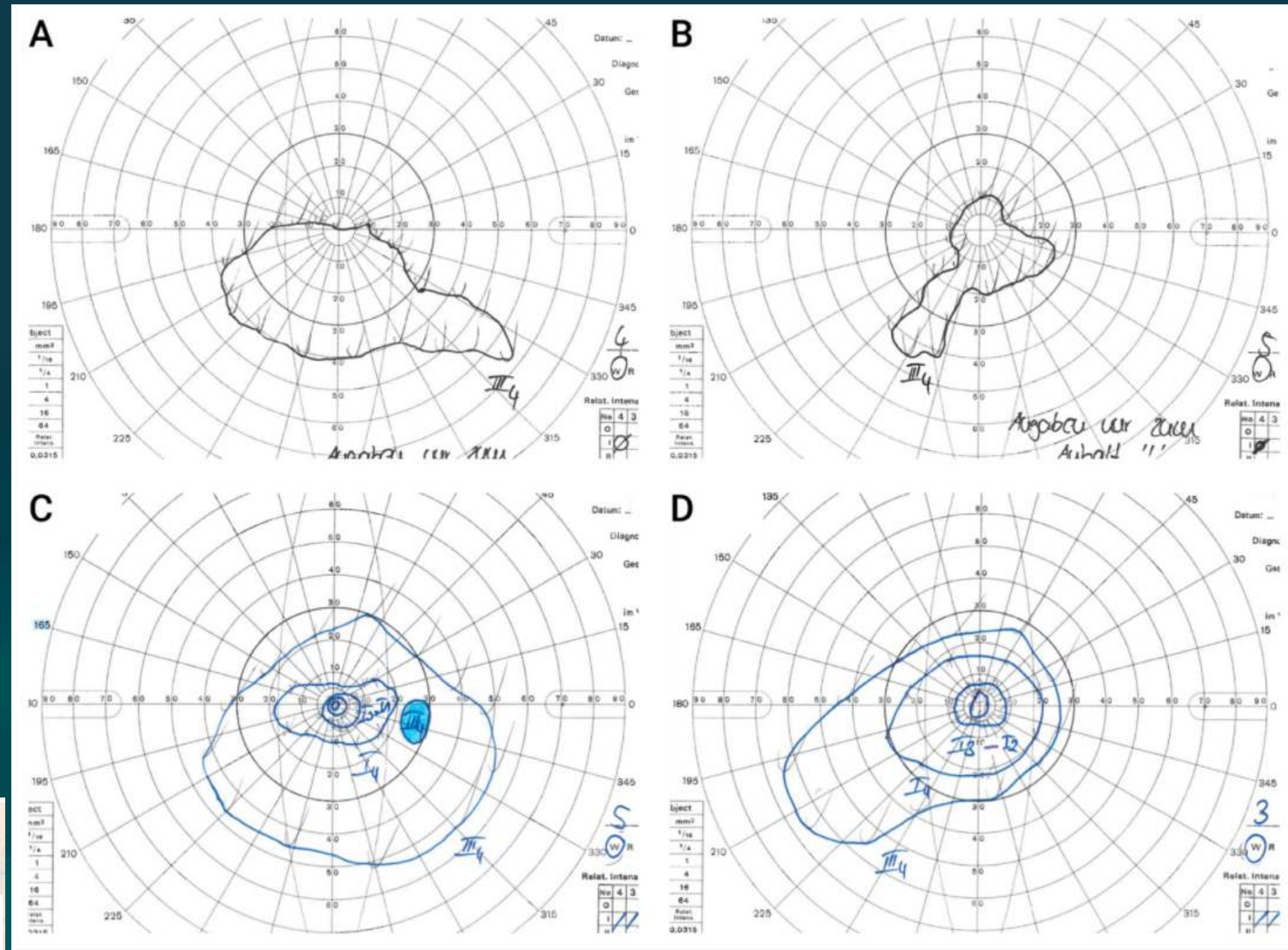
Gene Therapy

Gene Therapy

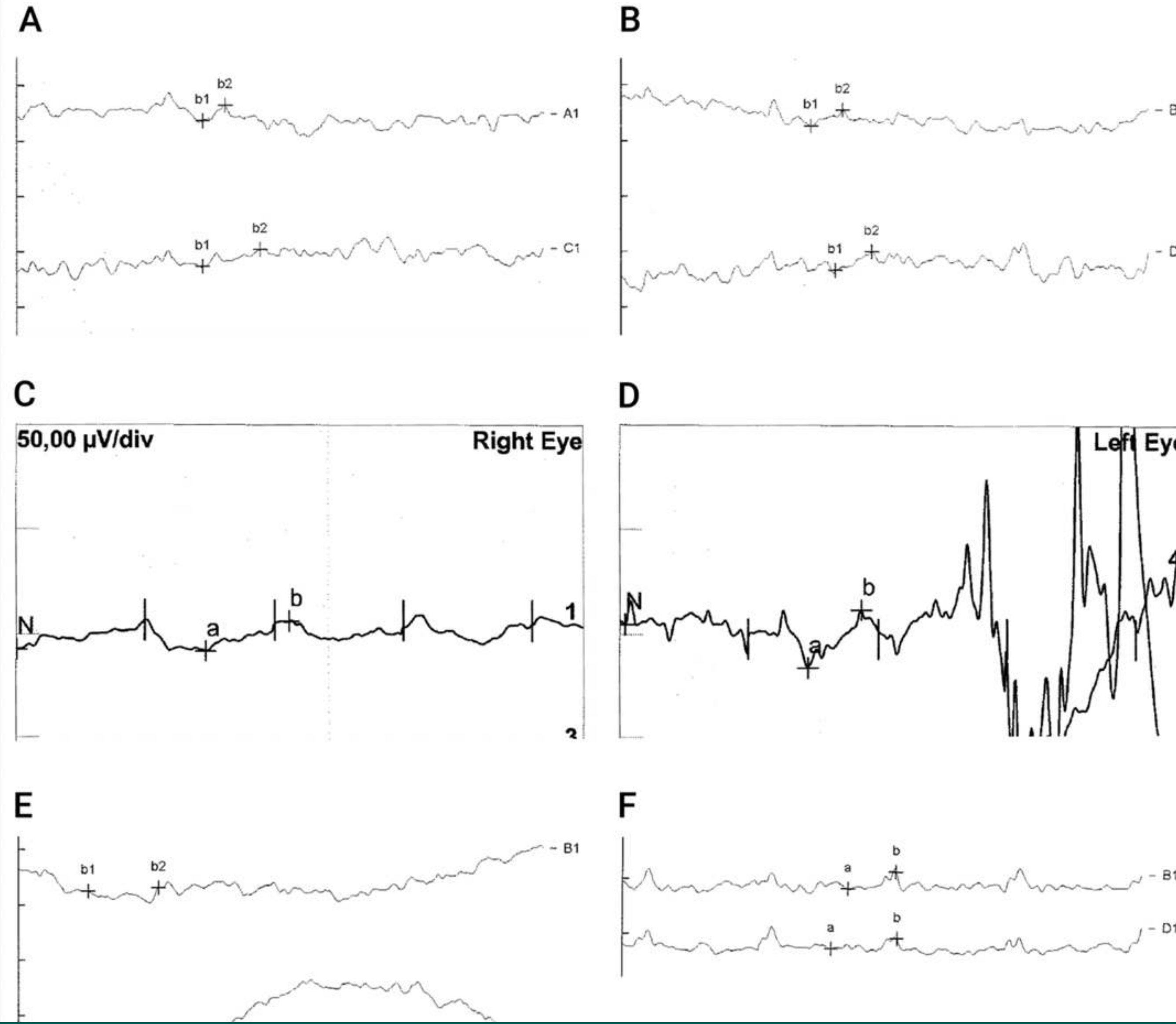
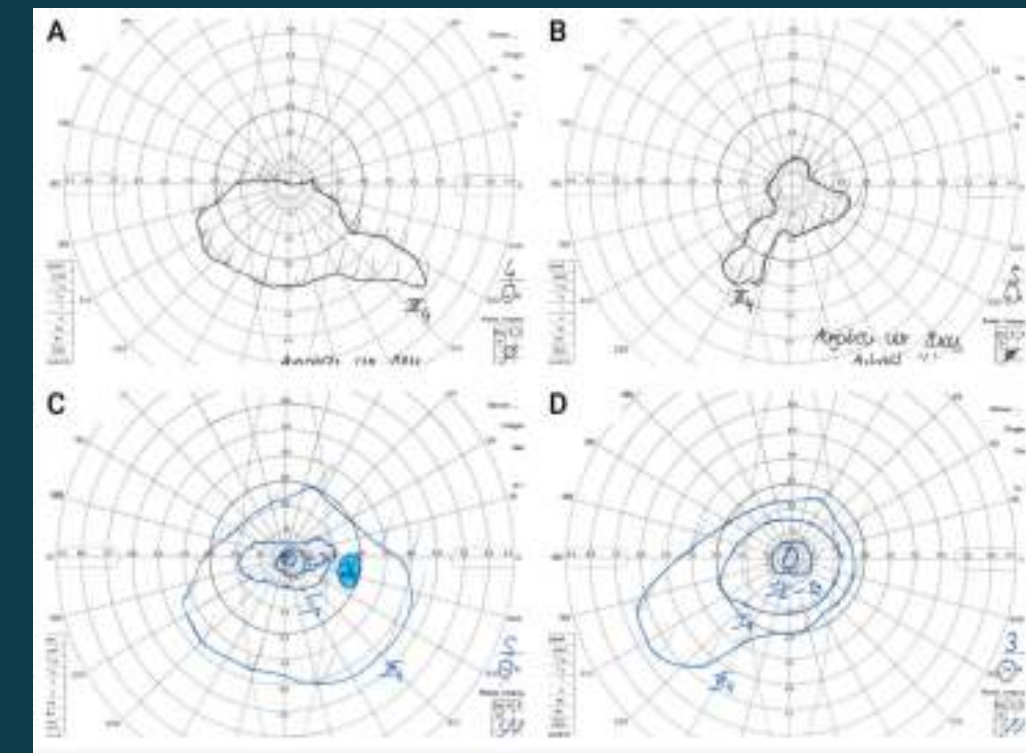


►The eye is a particularly well-suited organ for the application of gene therapy, as evidenced by the success of Voretigene- neparvovec gaining the approval of the FDA as the first in vivo gene therapy for the treatment of Leber congenital amaurosis.

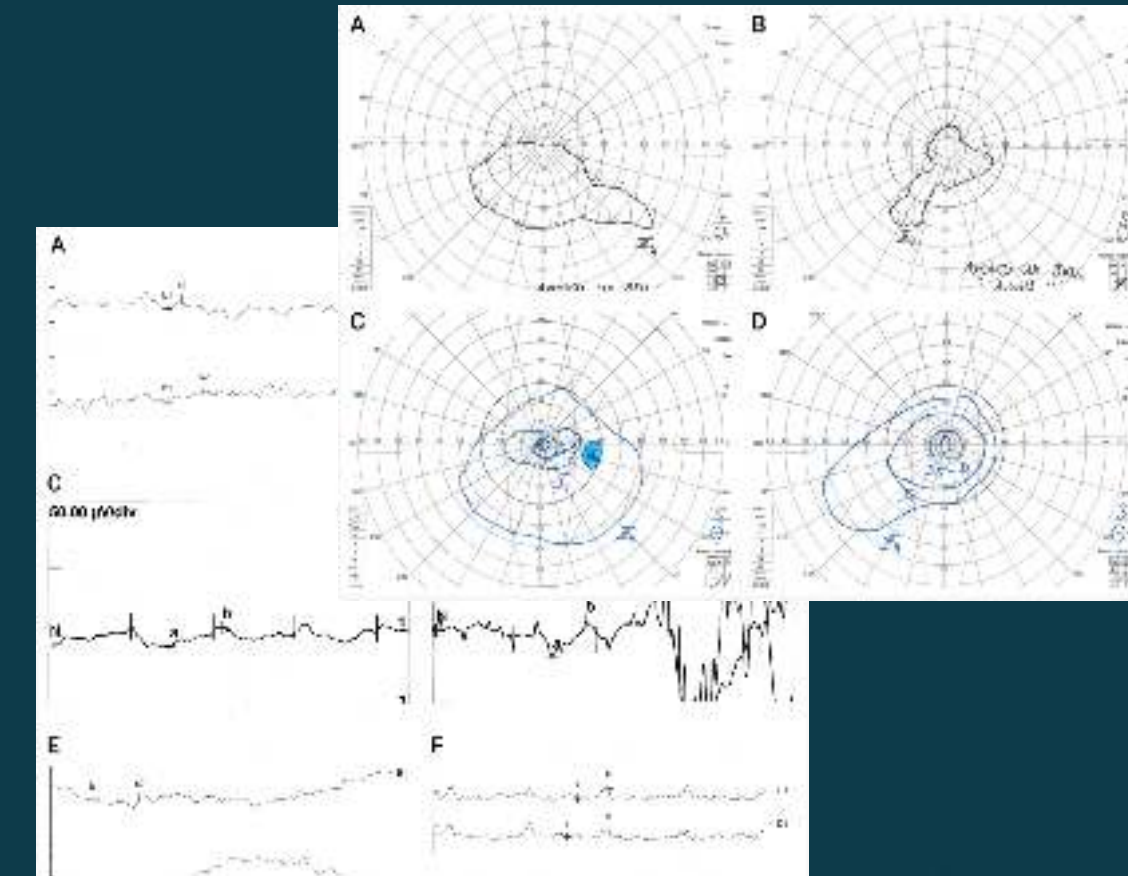
Gene Therapy



Gene Therapy



Gene Therapy



- ▶ Amongst the most common genetic causes of glaucoma is the myocilin gene mutation that affecting the trabecular meshwork.
- ▶ This gene accounts for only 4% of POAG cases.

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Gene Therapy



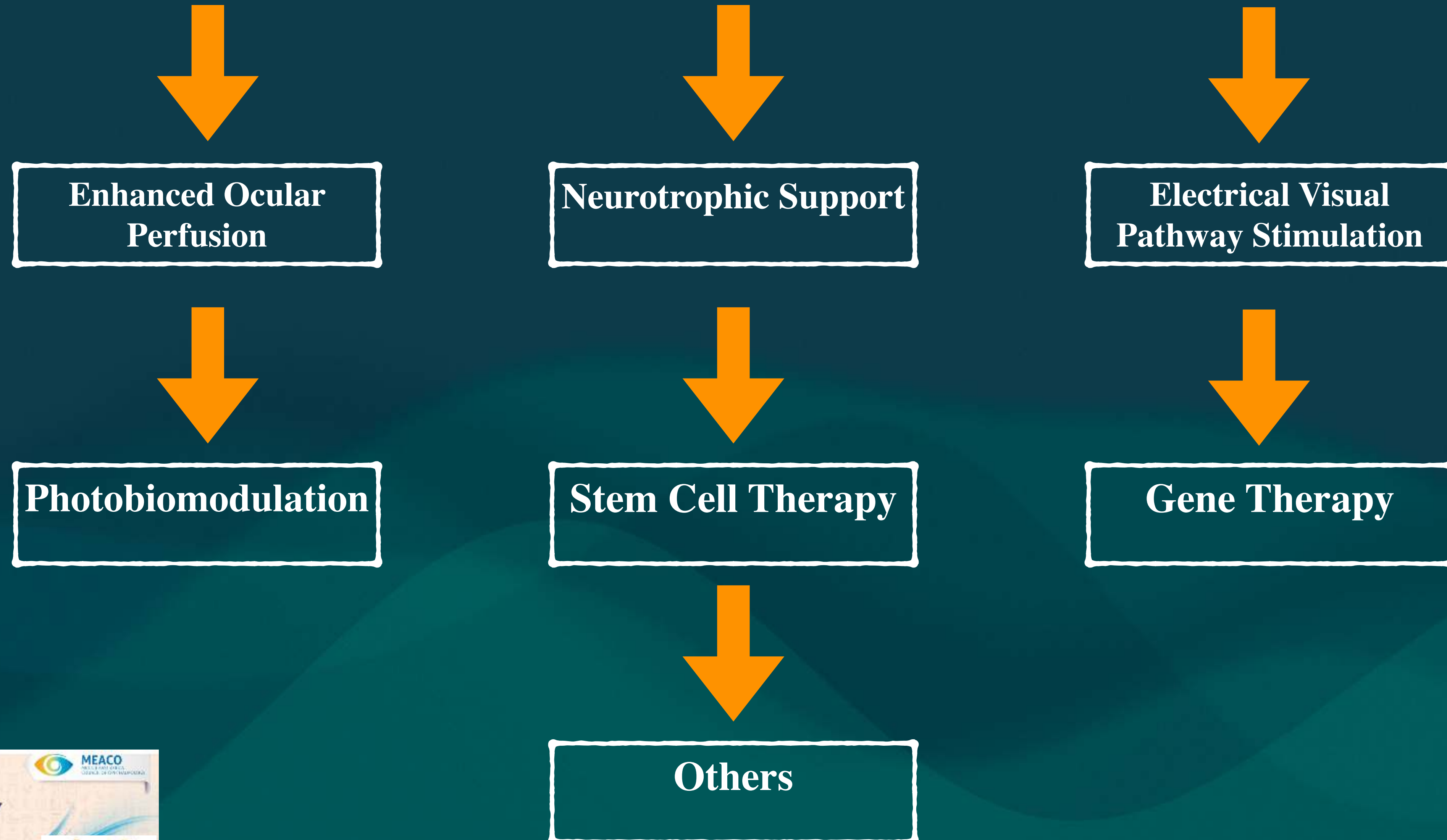
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- ▶ This gene accounts for only 4% of POAG cases.

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- ▶ In a preclinical model of glaucoma caused by this gene, Jain and coworkers were able to lower IOP in vivo through knocking down expression of the mutant gene using CRISPR-Cas9.
- ▶ This study provided proof of concept of using gene editing to treat glaucoma.

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Treatment Options Other Than IOP Reduction



Treatment Options Other Than IOP Reduction



Others

Treatment Options Other Than IOP Reduction

Others



Meditation



Exercise



Diet

Treatment Options Other Than IOP Reduction

Others



Meditation



Treatment Options Other Than IOP Reduction

Others



Exercise



Treatment Options Other Than IOP Reduction

Others



Diet



Others



Cannabinoids



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CAIRO, EGYPT



Cannabinoids



Marijuana for glaucoma?

Here's why doctors don't recommend it.



It's not as effective as prescription drugs.



It wears off quickly.



The large amount needed would impair your ability to drive, cook and function normally.



It could raise your risk of blindness.

Learn more at aao.org/eyesmart.

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Cannabinoids



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EDITORIAL

American Glaucoma Society Position Statement: Marijuana and the Treatment of Glaucoma

Henry Jampel, MD, MHS

Glaucoma is a disease of the optic nerve that can result in vision loss and blindness. Although many factors, some only partially understood, contribute to the optic nerve damage in glaucoma patients, it has been definitively established that the level of intraocular pressure (IOP) is related to the presence of damage,¹ and that treatments that lower IOP reduce the risk of developing initial damage,² and slow the progression of preexisting damage.³ Therefore, the mainstay of treatment for glaucoma patients is lowering the IOP.

There are 3 modalities in widespread use for the lowering of IOP: medications, laser treatment, and operating room surgery. Although historically, systemic medications in the form of oral carbonic anhydrase inhibitors had an important long-term role in lowering the IOP, their side effects have resulted in their almost total replacement by many classes of effective eye drops with many fewer side effects.

Despite the treatments available for lowering the IOP, there are some individuals for whom these treatments are either not tolerated due to side effects or in whom the IOP is not sufficiently lowered. In these situations, both glaucoma patient and physician look for alternative therapies.

One of the commonly discussed alternatives for the treatment of glaucoma by lowering IOP is the smoking of marijuana. It has been definitively demonstrated, and widely appreciated, that smoking marijuana lowers IOP in both normal individuals and in those with glaucoma, and therefore might be a treatment for glaucoma.^{4,5} Less often appreciated is marijuana's short duration of action (only 3 to 4 h), meaning that to lower the IOP around the clock it would have to be smoked every 3 hours. Furthermore, marijuana's mood-altering effects would prevent the patient who is using it from driving, operating heavy machinery, and functioning at maximum mental capacity. Marijuana cigarettes also contain hundreds of compounds that damage the lungs, and the deleterious effect of chronic, frequent use of marijuana upon the brain is also well established.⁵

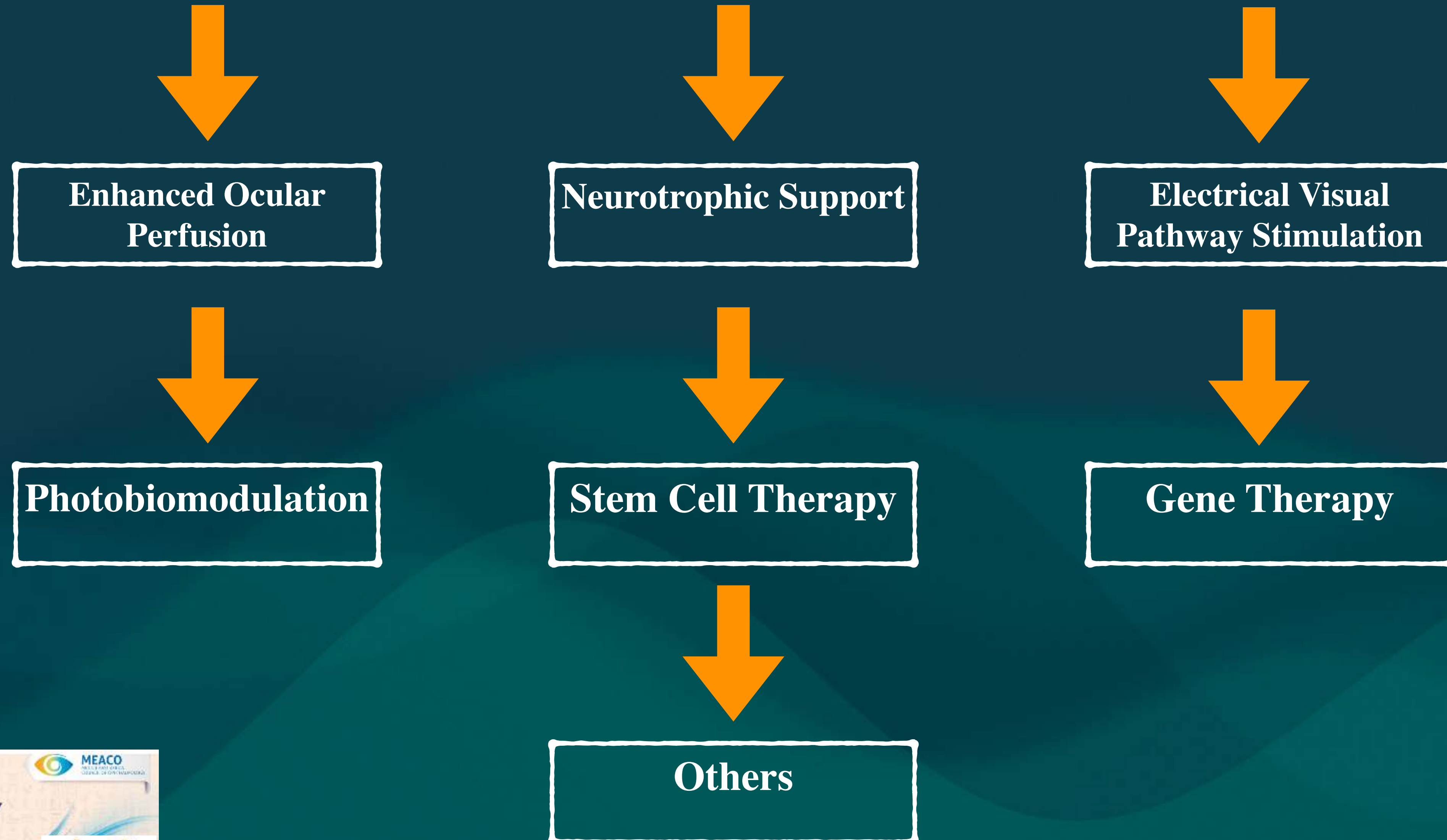
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Treatment Options Other Than IOP Reduction



Enhanced Ocular
Perfusion

Neurotrophic Support

Electrical Visual
Pathway Stimulation

Photobiomodulation

Stem Cell Therapy

Gene Therapy

Others

Glaucoma isn't just about pressure—it's a disease of the optic nerve and vision, and protecting them is all that matters.



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